SCIENTIFIC AMERICAN

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Vol. XCVII.—No. 5.
ESTABLISHED 1845.

NEW YORK, AUGUST 3, 1907.

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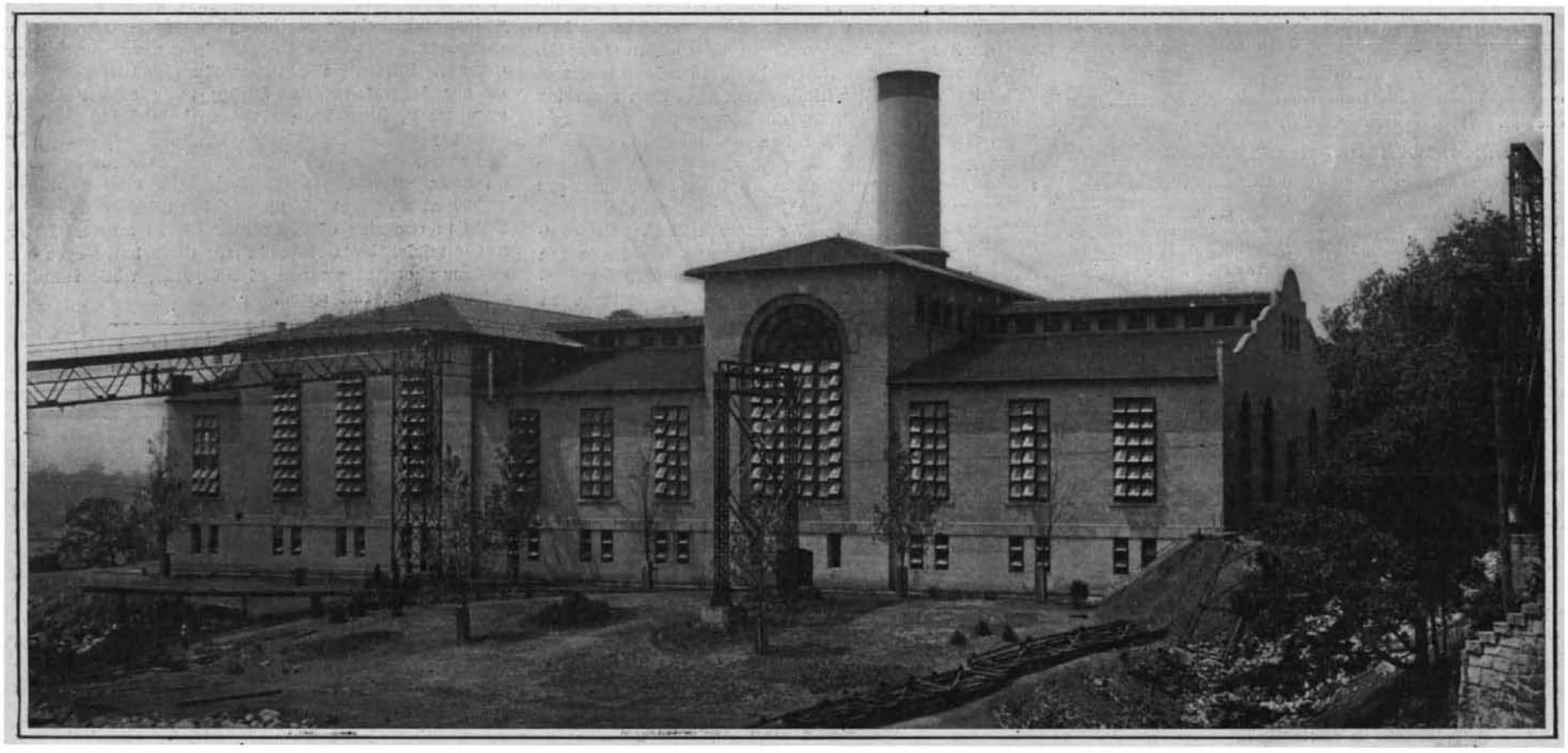

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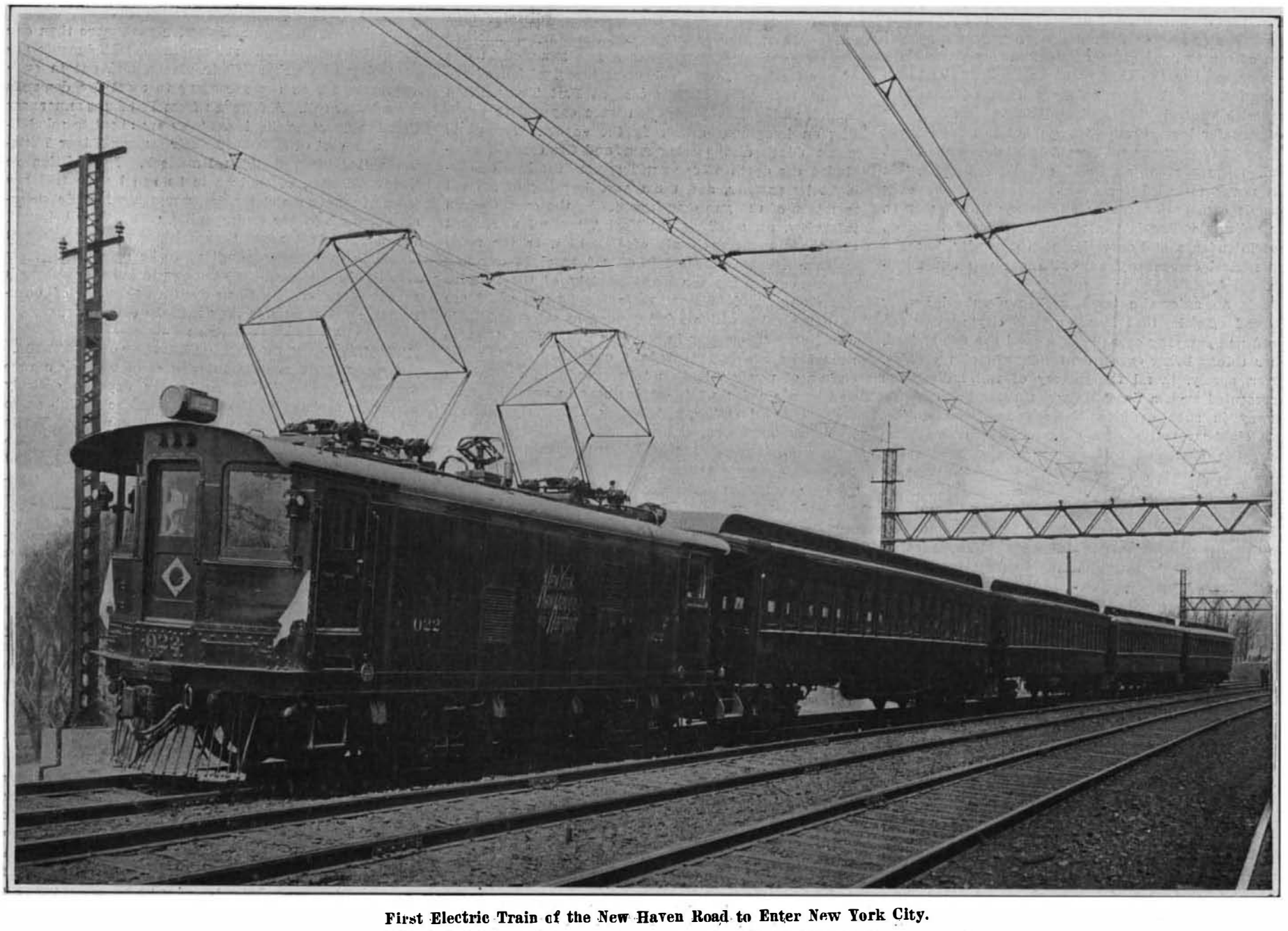
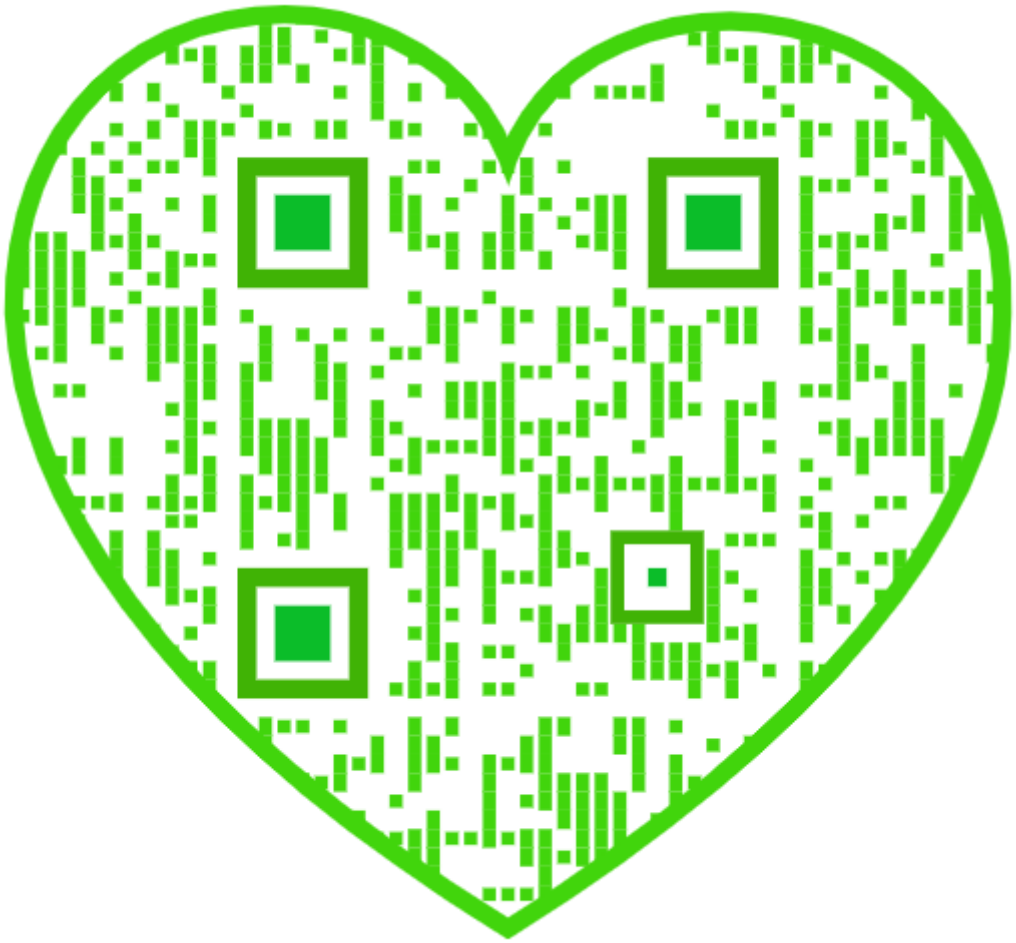


First Electric Train of the New Haven Road to Enter New York City.

INAUGURATION OF THE NEW HAVEN RAILROAD ELECTRIC SERVICE.—[See page 79.]



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ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States or Mexico.....$3.00
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One copy, one year, to any foreign country, postage prepaid, £0 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876).....5.00 "
American Homes and Gardens.....3.00 "
Scientific American Export Edition (Established 1878).....3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, AUGUST 3, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A COSTLY BLUNDER.

The most foolish and inexcusable blunder made in the provision of transit facilities in this city, was the failure of the operating company of the Rapid Transit Subway to install a type of car suited to rapid transit. There is no denying that in some matters the American people are marked by a rigid conservatism, which is in strange contrast to their general alertness and adaptability. Nowhere is this shown to more striking effect than in the blind persistency with which our railroad men insist on using the old end-door car for suburban and rapid-transit purposes. Ten years ago, in discussing the proposed subway, the writer of the present article, foreseeing the pit into which our rapid-transit authorities have deliberately walked, urged time and again the necessity for using a special type of car to handle the crowds which were certain to pour in upon the subway like a flood at the hours of busiest travel. The ordinary type of American car, with central aisle and end doors, is admirably designed for long-distance travel; but it is absolutely the worst type of car that could be designed for short haul, frequent-stop, city and suburban service. It was never intended for such service, and the only possible explanation of the existence of such cars in our subway to-day is the reluctance of car builders, superintendents, and operating men generally, to make any radical departure from existing forms and methods.

It is an axiomatic truth, well understood among railroad officials, that in a crowded city service the speed and carrying capacity of a road are determined, other things being equal, by the length of the stops. Never, surely, in all the history of railroading was represented such a fiasco as when, after building the subway in such excellent fashion and equipping it with eight-car trains with a speed of forty miles an hour, the operating company proceeded to throttle down the whole scheme and limit its carrying capacity by equipping it with the obsolete end-door passenger car.

In a recent and very excellent report presented by the City Club to the Public Utilities Commission, it is stated with much truth that the entire secret of the relief of the congestion on the subway at the rush hour lies in the adoption of a proper type of car door. Not even the notorious Brooklyn Bridge is more seriously hampered than the subway; for observation shows that 53 per cent of the passengers for Brooklyn obtain seats at the height of the rush hour, whereas only 41 per cent of those who travel by the subway can sit down. The limiting feature of the whole line is the long stops at the stations, and especially at the Grand Central; the delay being due to the length of time required to get passengers on and off the train through the two little end doors.

What is needed on the subway is not more trains, but more doors, coupled with the exercise of a little more common sense. The Interborough Company should begin at once to install the type of cars which is used by the Illinois Central Railroad for its Chicago suburban traffic, and has been in successful use in European suburban service for over half a century. Each Illinois Central car seats 100 persons, and there are twelve doors on a side. In response to inquiry, the officials of the Illinois Central Railroad state that the introduction of this type of car in their suburban service reduced the average time of stop from 30 seconds to 7 seconds. No platform men are required for the operation of the doors, which are opened and shut by the guards on the train. If these cars were adopted on the subway, instead of a maximum of 27 expresses an hour, the subway could accommodate 40 expresses; double the number of seats would be provided per car; and, in fact, 56,000 seats would be supplied every hour. This would leave a considerable margin for future increase of traffic.

THE PERILS OF THE LONG ISLAND GRADE CROSSING.

The gruesome collision of an automobile with an express train at a Long Island grade crossing, which occurred last Sunday, when two people were thrown into the ditch and burned to death by the oil from the broken gasoline tank, is the latest in a long series of fatalities of a similar kind, which have been occurring with increasing frequency during the past few years. The obvious duty of the railroad company is to abolish these grade crossings altogether, substituting at the intersection of their lines with the public highways either subways or bridges; indeed, they are under obligation to do so by law. We understand that the company is slowly doing this work, and has made the change at several places; but, considering the alarming increase in disasters, it is surely imperative upon the road to hasten the work, instead of permitting it to drag along in the present leisurely fashion. Absolutely inexcusable, however, is the present unguarded condition of many of these crossings. There are no gates, no gatemen, no flags, nothing, indeed, but an automatic gong which, it is stated, in the case of last Sunday's accident, was out of order. Pending the abolition of the grade crossings, the least the company can do is to render these places reasonably secure. Immediate steps should be taken to provide every one of them with gates and a gateman and some form of warning, either by flag or loud gong, which shall attract the attention of the automobilist sufficiently far from the crossing to enable him to make a safe stop. Automatically operated by the gates, there should be a signal which will warn the engineer by semaphore or red light, when the gate is open. These precautions are simple, easily taken, and sufficient to render the crossings safe until the change of grade can be made.

PERILS OF RECORD TARGET FIRING.

With the memory of the "Georgia" disaster still fresh in our minds, there comes the story of another similar accident—this time to a gun mounted in one of our land defenses. The premature ignition of the powder took place in this case at Fort Terry, Plum Island, while the artillerymen were engaged in repelling an imaginary attack by the enemy. The piece was a 6-inch disappearing gun, and the casualties included the death of one artilleryman, the loss of eyesight by another, and the severe burning of several members of the gun detachment. In the course of an interview, an artillerist at Fort Trumbull attributed the too-frequent accidents of this kind to the same cause which we outlined in this journal in our last issue, namely, the too great anxiety of the men to make a record, leading to their playing fast and loose with the rules which are intended to safeguard their own lives. The officer in question stated that, if there should be a damp spot in the cloth inclosing the charge of powder, it is apt to remain in the breech and burn slowly; while carelessness in swabbing may leave a small ember which may ultimately cause a premature explosion.

The Board which inquired into the accident on the "Georgia" reports that the powder was ignited by a "flare-back." This is nothing more nor less than we expected. There is no possible excuse for a "flare-back" having occurred; for since the terrible accident from the same cause which occurred a few years ago on the "Missouri," the navy has installed on our large guns a pneumatic device for blowing the remaining gases out of the gun before a new charge is inserted. The strength of this blast is sufficient to blow a hat or other light article entirely through the bore and out at the muzzle; and therefore if the air blast be kept on for a sufficient length of time, it is evident that all of the gases must be entirely expelled. In the case of the 8-inch gun on the "Georgia," the fact that these unburnt gases were not driven out is strong presumptive evidence that, in their laudable desire to make a speed record at the target, the gun detachment must have reduced the time that should have been occupied in blowing out the gun.

But after all, is the value of speed of fire not being very much overrated? It is accuracy more than speed which will count in a naval engagement. No gun captain will attempt, when on the battle line, to fire at anything like the speed which obtains in target practice; for he knows too well that if such a speed could be maintained, the ship's magazines would be empty before the battle was half over. More time between rounds means a larger number of bull's eyes on the target; and the slowest rate of fire in target practice will always be faster than the fastest rate of fire in battle.

GOOD WORK BY OUR SUBMARINES.

In spite of the prejudice under which the submarine labored in the earlier years of its development, and the indifferent results which were secured, it begins to look as though this type of vessel would, after all, fulfill the sanguine promises of its inventors. Although the detailed official report of the recent competitive trials off Newport has not been made public, enough has leaked out to show that in our latest submarines we possess very capable vessels. The "Octopus" proved to be fast both above and below water, and she passed through unusually severe submergence tests at great depths in a most satisfactory manner. Recently the "Octopus" and "Cuttlefish," two of our largest vessels, during their official acceptance trials, have broken the records for submerged target practice. The "Cuttlefish," while running at full speed submerged, that is to say at about 10 knots an hour, made two bull's eyes with Whitehead torpedoes at a range of 500 yards, the third shot being a little to one side of the center of the target. Later in the trials, the "Octopus" made three bull's eyes out of four shots, at a range of 800 yards, while running submerged at full speed.

BRIGHT OUTLOOK FOR BETTER RAILS.

It is seldom that an agitation meets with such immediate success as that which has resulted from the recent exposure of the poor quality of rails which have lately been furnished to the railroads. As between the railroads and the railmakers, conditions have been completely reversed. Three months ago, the railroads were urging the manufacturers to give them a better product; to-day, it is the manufacturers who are urging the railroads to come to a speedy conclusion as to what kind of rail they require, in order that the present stagnation of the steel rail business may be relieved. It was a wise move on the part of the railroads, when they jointly determined to place no more orders with the mills until some better understanding had been arrived at, and a specification drawn that would meet the present conditions. There is evidence that the manufacturers are sincerely anxious to co-operate with the engineers of the railroads; and it is only fair to recognize the fact that the former had already shown a conciliatory spirit before the present falling off of orders began.

We note with much satisfaction that more than one of the more important rail-making establishments are preparing to overhaul their plants, and put in such improvements as are necessary to meet the demands for a better rail. A dispatch from Pittsburg announces that the Carnegie Steel Company are about to rehabilitate, at a cost of $2,000,000, their famous Edgar Thomson rail-making plant in Braddock. In addition to the installation of engines to be run by the fuel gas from blast furnaces, the improvements include extensive changes in the rolling mills, which, it is believed, will secure that more thorough working of the rail which is universally admitted to be necessary. It is also the intention of the company to build open-hearth furnaces, to enable them to furnish rails of open-hearth steel whenever they may be called for.

DESIGNER FIFE ON THE "AMERICA" CUP CONTEST.

Apparently, the question of a challenge for a race for the "America" Cup next year depends entirely upon the decision of the New York Yacht Club as to which rule the contest must be sailed under. While on his way through New York to the "Canada" Cup races, Mr. Fife, the designer of "Shamrock I." and "Shamrock III.," stated that he regarded the prospects of an "America" Cup race next year as very bright. According to this authority, if a challenge is sent over this summer, it will bear the express stipulation that the race be held under the present rules of the club, and there is not the slightest likelihood of any challenge being sent over for a race to be sailed under the old conditions. Mr. Fife expresses his belief that there is absolutely no chance of England or any other foreign country being able to win the "America" Cup under the old rule. This opinion is probably shared by the majority of yachtsmen upon both sides of the Atlantic. The old rule, which was based merely upon a load-waterline and sail-area measurement, produced a fast light-weather boat, of such slight construction and exaggerated proportions that it was good for nothing more than a contest in a smooth sea and a moderate breeze. Not one of the later cup challengers and defenders has been put to any use whatever, subsequently to the sailing of a series of "America" Cup races. They are too broad, too flat, too long, too light, too heavily ballasted, and too heavily sparred to be of any possible use for cruising purposes. Moreover, they require for their handling as big a crew of men as is necessary for a large ocean square-rigger.

The new rule of the New York Yacht Club, to which Mr. Fife refers, was drawn up by a committee of the club expressly for the purpose of curtailing the exaggerations of form and construction above referred to, and producing a yacht which, while it was fast and seaworthy, would also be strong and staunch, and capable, after a series of races, of being readily transformed into a comfortable cruiser, should the owner so wish. In spite of the fact that some of our yacht designers have criticised the new rule, and predicted that naval architects would be able, by a skillful manipulation of its provisions, to produce yachts which would be practically as exaggerated as those built under the old rule, the experience thus far had shows the new rule to be a decided improvement, the new boats being handsome in form, almost as fast as their predecessors, and exempt from the many faults of the earlier type. The races for the "America" Cup have always been enormously popular, and of late years the contests have been marked, both on the part of the yachtsmen and the general public, by a spirit of fair play, which is in keeping with the best traditions of this, the noblest of all sports.

The majority of the yachtsmen and the whole of the American people will welcome a challenge; and a decision of the New York Yacht Club to arrange a series of races under their own new rule would meet with universal approval.

A FLEET OF FRENCH MILITARY AIRSHIPS.

The question of the use of airships is one which is very active in Europe at present, especially in France, Germany, and Italy. Upon the state of affairs in France, an important piece of news appeared not long since, and while it must be taken with some reserve, it is nevertheless worthy of mention. Although the military authorities decline to give any information on the subject, it has leaked out that the preparations for the new fleet of airships which is to be used by the army are being carried forward with all possible diligence, and there are no less than five airships to be constructed, of the same type as the "Patrie." These will be turned over to the government in March, 1908. It appears that three of the new airships will be constructed by Messrs. Lebaudy at their headquarters at Moisson, near Paris, while the other two are to be built at the government aerostatic establishment of Chalais-Meudon, near the city. It is the intention to provide a large fleet of airships in the future, as the War Department is now quite convinced of their great value in military maneuvers, for various purposes. Such airships will be constructed in series of five, and the above programme relates to the first five of the fleet, exclusive of the three Lebaudy airships which are already built, including the "Patrie." While the general type will remain the same, the object is to make improvements in detail in each of the series of five airships as they are constructed. As to the first five airships of the fleet, they will be distributed among the principal fortified posts in the center and the eastern frontier regions. Among these will be the forts of Belfort, Verdun, Toul, Besançon, and the camp at Chalons. The work of erecting the sheds which are to house them has already commenced. For some time past the War Department has been paying special attention to the subject of training the aerostatic corps, so that it will be able to handle the airships with certainty. For this purpose one of the airships is stationed permanently at the Chalais-Meudon establishment and the drills are constantly being carried out. It appears that the new Aerostatic Corps is to be composed of no less than 48 officers of the military engineer corps and 92 regular army officers who are chosen for their competence in aerial navigation work and their experience in mechanical engineering. Not long since the airship "Patrie" made a series of flights from Meudon to Paris and return, with the object of drilling the crews in actual flight, which is rightly estimated as one of the most important parts of the work. One of these, on the 8th of July, was the fourth flight which the "Patrie" made during the season. Starting at 7.50 o'clock A. M. it made some evolutions about the Chalais grounds, then started for Paris, mounted by Commandant Bouttiaux, Capt. Voyes and other officers of the Aeronautic Corps. After passing over the suburbs and entering Paris, it made several circuits above the city and then came back to its quarters at 9.10. The total distance, 34 miles, was covered in 1 h. 20 min. at the rate of 25 miles an hour, and this is a remarkable result, seeing that the airship had to struggle against a west wind blowing at a considerable speed. Another flight was made over the city on July 12 including a wide circuit through the region, lasting for nearly two hours. It was quite successful, and about the same speed was made. The landing can be carried out with ease, in spite of the fact that the station at Meudon is quite surrounded by woods, and the maneuver was made with great precision, entirely by the use of the movable steering planes. Capt. Voyer and five others formed the crew.

PRESENT AND PROSPECTIVE DOCKING FACILITIES OF THE PACIFIC COAST.

BY H. A. CRAFTS.

Now that it has become an established fact that the main strength of the United States navy will be transferred temporarily, at least, to the Pacific, it becomes interesting to know what the present and prospective docking facilities are on that coast. Outside of possible accidents, the cruisers and battleships will have to be docked at stated intervals in order to have their hulls cleaned and repainted. As a matter of strict economy, it is said that a steel bottom ought to be cleaned and repainted at least once a year. Now on the entire Pacific Coast the United States government has just two drydocks—one at Mare Island in San Francisco Bay, and another at Bremerton, Wash., on Puget Sound. Both of these are graving docks, and are distinguished from the floating drydock by being built into the land, and being therefore fixed and permanent. The government drydock at Mare Island is of granite, 513 feet long over all, with a width of 80 feet 7 inches at the entrance, and a depth of 27 feet 6 inches over sill. The government drydock at Bremerton has a wood body and masonry entrance. Its length over all is 650 feet, width of entrance 92 feet 8 inches, and depth over sill 30 feet.

The inevitable naval base under the new order will, of course, be at San Francisco; and the docking facilities of that port consequently become a subject of more than ordinary importance. As may be readily seen, the drydock at Mare Island will be far inadequate to the needs of the occasion, when the mobilization of Uncle Sam's fleet on the Pacific becomes an accomplished fact. To be sure, a second graving drydock at Mare Island has been under process of construction for the past six years; but from various causes much delay has been occasioned, and it is stated upon good authority that it would take two or three years to finish the work, even though it were to be hastened with all possible speed. This new dock when finished will be 720 feet long, 102 feet wide, and 30 feet deep. The chief difficulty thus far encountered is in securing a substantial foundation. The formation composing its site is hardly more than a deep bed of mud; and in order to secure a foundation that will hold up the structure when finished, it is found necessary to drive a dense mass of wooden piling. Upon this foundation it is proposed to build the dock of reinforced concrete.

Fortunately, however, the government need not depend upon itself for docking facilities in San Francisco Bay. At Hunter's Point on the west shore of the bay, five miles south of the city of San Francisco, the San Francisco Dry Dock Company operates a very extensive plant, and has already done considerable docking for the government, notably in the docking of the battleship "Oregon" in 1894 and the cruiser "New York" in 1903. Recently Howard C. Holmes, chief engineer of the company, has completed plans for the largest drydock in the world, to be soon constructed by the company at Hunter's Point. The company's present plant consists of two graving docks and two floating docks. The first graving dock was completed in 1868. It is 490 feet long over all, 97 feet wide at the gate top and 56 feet wide at the gate sill; midships it is 117 feet wide at the top and 58 feet wide at the bottom. This dock has wooden altars and wooden caisson. The second graving dock was completed in 1903, and in it the battleship "Ohio" was docked in February of that year. This dock is 750 feet long over all; width at gate top, 103½ feet; at gate bottom, 86 feet; midships at top, 122 feet wide and 74 feet at bottom. This dock has concrete altars and a steel caisson; it is filled through the caisson, while the old dock is filled through a seven-foot tunnel.

The largest drydock in the world to-day is at Belfast, Ireland; San Francisco will shortly possess a dock of even greater dimensions. The new drydock above referred to will be 1,050 feet long from gate to the landward extremity; width at coping, 144 feet, and at bottom, 92 feet; depth over sill and below coping, 39 feet 10 inches, or 34 feet 6 inches at high water. The interior facing of the dock will be of reinforced concrete of an average thickness of 15 inches; and the altars will be of the same material. The stairways and timber slides will be formed in the main body of the dock, and will be flush with the surface of the same. Such portions of the sides of the dock as will be above the rock formation underlying the site will be reinforced concrete, and will be proportional in thickness to the height of the same, and anchored into the rock with structural steel posts. The gate seat proper will be of dimension granite, but the approach and buttresses will be of reinforced concrete. The keelsons are to be of Douglas fir and the flooring of Port Orford cedar, all anchored and embedded in a sub-floor of cement. The drainage of the dock will be by surface gutters connected with a sump. The caisson or gate will be of steel construction, and will be virtually a vessel 147 feet long at the deck, 128 feet long on the keel, with a beam of 26 feet and a depth from deck to bottom of 41 feet.

The pumping plant for the new dock will consist of four 54-inch centrifugal double suction pumps with a joint capacity of 200,000 gallons of water per minute. Each pump will be driven by a 500-horse-power three-phase electric motor, using 440 volts. These will be located at the bottom of the pump pit, and will be so arranged as to be started from the gallery at floor level, it being the intention to use the high-tension current of one of the public service power companies, say at 1,000 volts, and transform the same to the requisite voltage.

The dock will hold 24,000,000 gallons of water, but with the pumping plant described may be pumped out within the space of two hours. The earth conditions at Hunter's Point are very favorable for the construction of graving drydocks, the site of the present docks and of the proposed dock being underlaid with what is known as green serpentine rock, forming a very solid foundation, as well as substantial backing for the sides.

The new dock was neither conceived nor planned in anticipation of any possible massing of the United States navy, but in anticipation of the constantly increasing size of ocean craft and the growing importance of the Pacific Ocean as a maritime field of operation. Some idea of the increase of the size of ocean-going ships may be obtained from the following:

Date.	Length of longest ship.
1840	200 feet
1855	375 feet
1881	525 feet
1905	675 feet
1907	786 feet

The last length cited is that of the "Lusitania" and "Mauretania," now building, and already they are talking in nautical circles of ships that will be 1,000 feet long; and this is a class that will call for a dock of 1,000 feet length and over.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1648, for August 3, contains a large variety of interesting and instructive material. That fascinating mystery, the planet Mars, has again approached the earth this summer; once more the canals and spots will be discussed, and the chances of the habitability will be thoroughly reviewed. Prof. Andrew Ellicott Douglass, who has made a careful study of Mars at Flagstaff, Arizona, contributes a paper on "Illusions of Vision and the Canals of Mars," in which he seeks to explain many of the Martian phenomena on the basis of fundamental defects in the human eye. "Glacial Geology" is the title of an article in which modern theories of glacial climate are outlined by the well-known geologist William North Rice. The shape of the earth is discussed on the basis of a theory of gravitational instability. The Temple of Aizani is described in detail. A system of traction which is designed especially for use upon heavy grades, has been brought out in France within a recent period. The principal feature of this system is the use of a type of locomotive in which a third rail, lying between the main rails of the track, is grasped between the wheels or rails, which thus serve to give an increased adherence to the locomotive, so that a comparatively heavy train can be propelled up a steep grade. The locomotives are described with considerable detail and are illustrated. An abstract of Mr. Allerton Cushman's noteworthy paper on the corrosion of iron is published. Mr. Cushman advances the theory that electrolysis is the cause of iron rust. In an article on the "Form and Energy of Sea Waves," the subject of ocean mechanics is popularly treated. The SCIENTIFIC AMERICAN'S English correspondent writes on "A System of Reinforcing Concrete Sea Defenses," which has been devised by M. de Muralt. By far the most important article from a mechanical standpoint which is published in the current SUPPLEMENT is Mr. Harold L. Brown's thorough *résumé* of "Motor Starting Devices for Gasoline Automobiles." The article is very fully illustrated with photographs and diagrams of the various systems which have been used from time to time. In the article on the Preservation of Timber some valuable data on penetration are given. Day Allen Willey writes on Copper Refining Machinery.

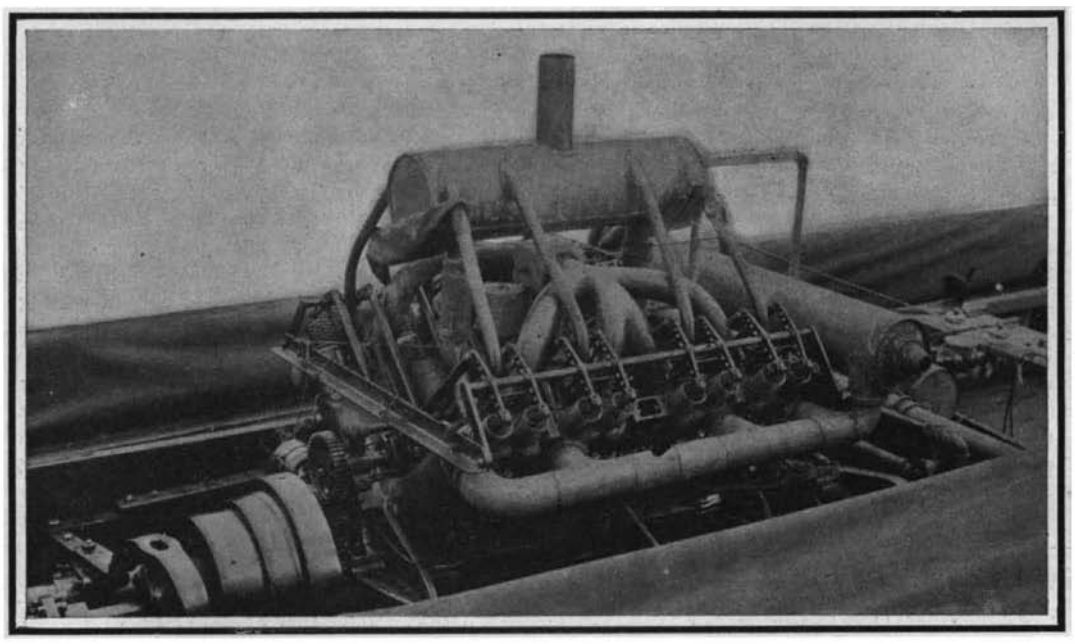
The Swiss exports of clocks, watches, and parts to the United States last year was the largest in the past twenty years, their value being $2,469,516, against $2,261,519 in 1905. This trade, which amounted to $1,671,028 in 1887, declined in 1895 to $1,000,000, continuing the retrogression until 1898, when the shipments of time-pieces to America amounted to but $746,240. Since that time the trade has been rapidly recovered. Music boxes from Switzerland no longer find the wide sale as formerly, the sales in 1887 having amounted to $235,415 and in 1890 to $300,708. There has since been a continuous drop, the exports amounting to but $52,174 in 1905 and $43,151 in 1906.

A PRACTICAL GLIDING CRAFT WITH SUBMERGED HYDROPLANES.

For many years there have been numerous attempts to invent and perfect a type of boat that, by reason of its gliding over the surface of the water, or above the surface, would be able to attain a high speed without the expenditure of the tremendous horse-power required with all ordinary craft when an attempt is made to increase their speed to any considerable extent. As is well known, the horse-power required to propel an ordinary boat through the water increases as the cube of the speed; therefore, to double the speed of such a boat, eight times the horse-power is required.

For a number of years past, Count de Lambert, in France, has experimented with catamarans fitted with a series of hydroplanes arranged transversely across the pontoons. In his early experiments, he obtained a speed of 24 miles an hour with about 12 horse-power; but in the later experiments, which were made quite recently upon a much larger scale, a somewhat larger boat, fitted with a 50-horse-power gasoline engine, was unable to exceed this speed very much, whether driven by a water or an air propeller.

In our Motor Boat number of 1906, we illustrated a boat equipped with submerged hydroplanes, that is, hydroplanes arranged on vertical stanchions below the boat, and adapted to raise the boat completely out of water. These experiments were rather primitive, but the Messrs. Meacham, who made them, claimed that this type of hydroplane was considerably more efficient than the surface type usually employed. Another noted experimenter, who has been working along this line for several years past, has recently made a very successful demonstration with his new gliding craft, and some photographs of this novel craft going at high speed and also at rest, showing the planes below the hull, are reproduced herewith. We refer to Dr. Peter Cooper Hewitt, the well-known inventor of the Cooper Hewitt mercury vapor lamp. Mr. Hewitt, like many another man of science of the present day, is interested in the problem of aerial navigation. He believes that much the same laws govern the action of an aeroplane or a hydroplane. The main difference is the density of the two fluid mediums, the air being about 800 times lighter than the water. As experiments are much more readily carried out on the water, Mr. Hewitt undertook to test some of his ideas in a hydroplane boat; and the craft shown, as well as its motor, is entirely of his own design and construction.



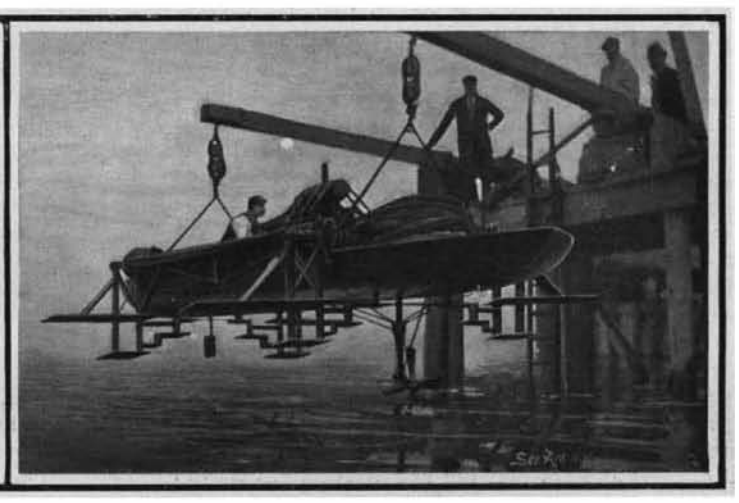
Cooper Hewitt's 8-Cylinder Motor Installed in the Hull of His Gliding Craft.

The Cooper Hewitt gliding craft consists of a light mahogany hull having a rounded bow and stern. The hull is suspended within a strong rectangular framework of heavy steel tubing. This frame contains an eight-cylinder gasoline motor firmly mounted upon a sub-frame forming part of it, and which is within the hull. Near each corner of the outer frame, vertical trussed sheet-steel frames project downward and carry sets of hydroplanes, which are terraced like a row of steps, the uppermost planes of each pair being connected together across under the boat by a horizontal strip. Four larger planes are placed with their forward upper edges about on a level with the bottom of the boat. These planes project outward several feet from the side of the craft, and are suitably braced as shown in the photograph. The propeller is placed at the forward end of the boat on the bottom of a long vertical shaft, which projects downward through the hull, and which is inclosed in a suitable tubular casing. There are two sets of bevel gears, one at the top of this shaft and another at the bottom. Each set consists of two bevels, and both sets are very compact and strong. The short shaft from the upper bevel gear box extends rearward to the friction clutch, which is mounted on the end of the engine crankshaft. The propeller used is a four-bladed one having blades of 22 inches diameter and 38 inches pitch. As it sets in a vertical plane and exerts a horizontal thrust on the water, it has no lifting effect.

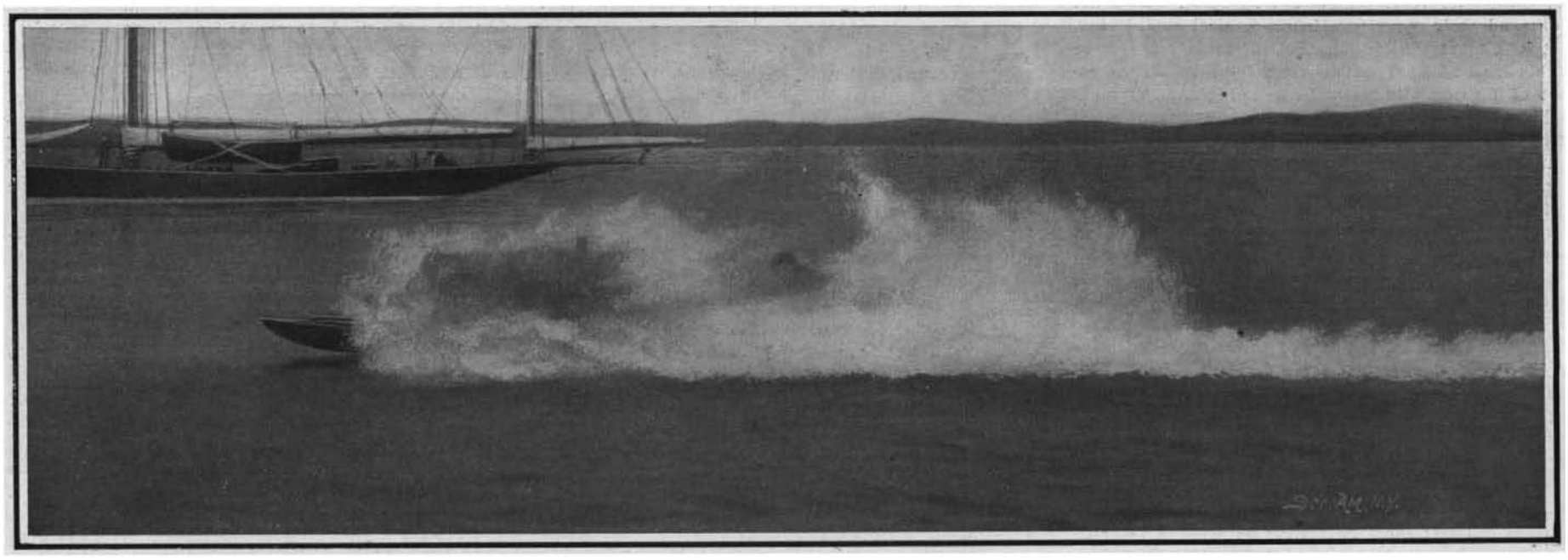
The gasoline engine is of the 8-cylinder type with the cylinders placed at an angle of 90 deg. Its eight thin, light, nickel-steel cylinders are provided with sheet-brass water jackets and bolted to an aluminium crankcase. The cylinder heads screw on the cylinders. The heads carry the valves, which are provided with a cast water jacket. All the valves are mechanically operated from a single camshaft by means of push rods and rocker arms. The engine is fitted with both high-tension and low-tension ignition by means of a battery with single coil and distributer and by a magneto. The top of the latter can be seen back of the exposed 2-to-1 gears in the photograph. The clutch is also visible below these gears. No flywheel is needed. The inlet pipes all connect with a single float-feed carbureter, while the exhaust pipes connect to two pipes running along each side and terminating in a muffler that extends across the boat, back of the engine. The cooling water is circulated on the thermo-siphon principle. From the bottom of the cylindrical tank seen above the engine, eight pipes extend downward to the bottom of the water jackets of the eight cylinders, while eight larger pipes run from the heads of the cylinders into the top of the water tank. A gear water pump sends cold water into the tank continually, and the tank is provided with an overflow. By varying

(*Continued on page* 78.)

The Boat at Rest, Showing the Waterline.



The Hydroplanes and Propeller Below the Hull.

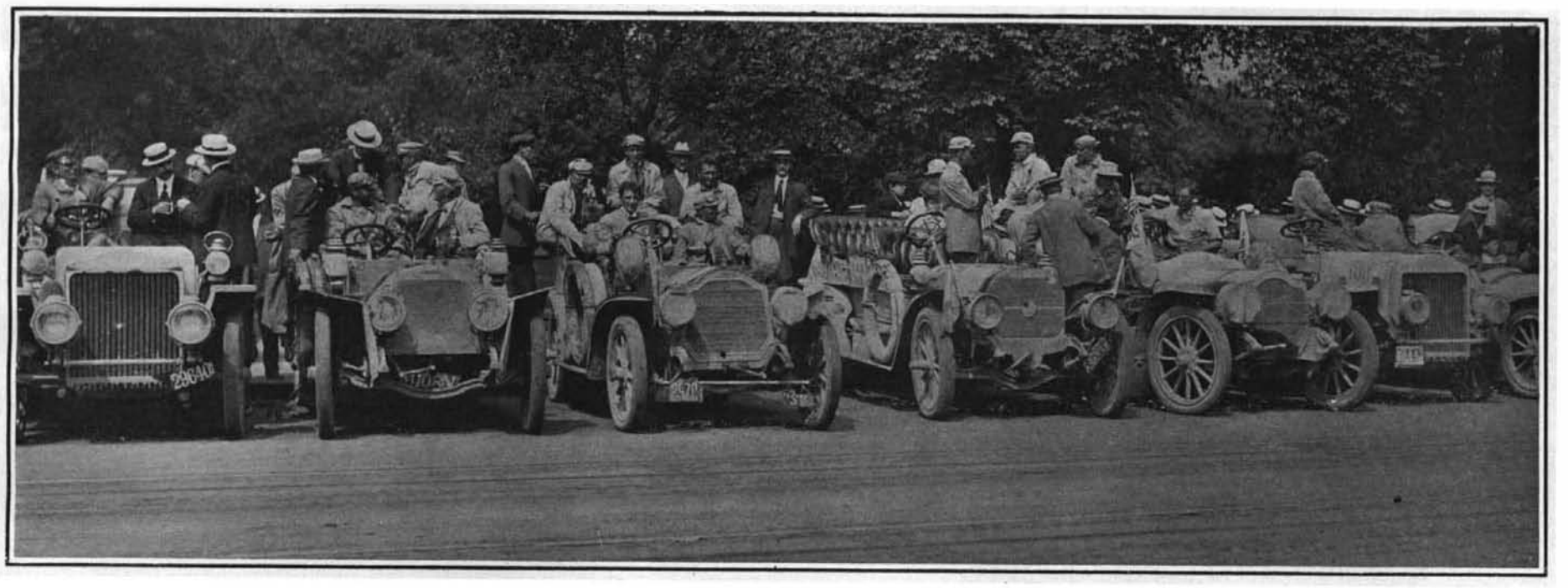


The Hydroplane Traveling at Full Speed, Making Over 30 Miles an Hour. In Smooth Water, Little, if Any, Spray is Thrown.

VIEWS OF MR. COOPER HEWITT'S NEW GLIDING CRAFT WITH SUBMERGED HYDROPLANES.

RESULTS OF THE AMERICAN AUTOMOBILE ASSOCIATION'S FOURTH ANNUAL TOUR FOR THE GLIDDEN AND HOWER TROPHIES.

On Wednesday, the 24th ultimo, by the arrival in New York of 55 mud-covered and travel-worn automobiles, and the assemblage of most of these cars along the south side of Central Park on 59th Street, the fourth annual tour of the American Automobile Association was brought to a successful termination. The tour was the longest and the most strenuous test of ordinary touring automobiles that has ever been held either here or abroad, and that no less than 21 machines should have competed with perfect scores under the rules, is indeed remarkable, and is a clear indication of the degree of perfection to which the modern automobile has come, in America.



White Steamer. Pierce Arrow Packard Welch Thomas White

Some of the Perfect-Score Cars as They Appeared in the Line-up at the End of the Tour.

In our last issue, we described the progress of the tour as far as Pittsburg. The ninth day's run of 97 miles, from Pittsburg to Bedford Springs, Pa., was not so difficult as had been anticipated. There was plenty of hill climbing and coasting, the longest climb being 4 miles in length up Laurel Ridge. When the summit was reached, the cars were enveloped in the fog. The roads were rough in places, and the roadbed was largely of clay. Overheated engines and burnt-out brakes were the chief troubles experienced during this day, and many of the contestants had a great deal of tire trouble as well. The runabouts in the Hower trophy were the chief machines to suffer from the rough roads and high hills. A 6-cylinder Pierce runabout lost 6 points through a delay due to tire and other troubles, and a Dragon runabout was delayed by transmission trouble, and withdrawn so repairs could be made. The Pennsylvania runabout broke the steering-lever arm. The Premier runabout did not start from Pittsburg, owing to illness of its driver. At the end of this day's run, but two runabouts remained with perfect scores. These were the 30-horse-power White steamer and the 35-horse-power Stoddard-Dayton. Both these cars completed the remaining three days' run with perfect scores, and it has been found necessary to give them a supplementary test run from New York to Cleveland, in order to determine which will be the winner of the Hower trophy. By the delay of Pierce car No. 21, due to tire trouble and to the bouncing out of the owner's boy on one of the "thank-you-ma'ams" encountered, the Pittsburg Club, which previously had a perfect score, lost 22½ points, and dropped behind the Buffalo Club, which lost 18 1-5 points on the seventh day. As neither of these clubs had any further penalization, the Buffalo Club was declared the winner at the completion of the tour. The cars which made up the Buffalo team consisted of two Pierce, two Thomas, and one Packard touring car. The Glidden trophy was won by a Pierce machine in the last two tours, so that this makes three times in succession that Pierce cars have won, or have been instrumental in winning, this trophy. Among other cars which had trouble in the ninth day's run were the Columbia gasoline-electric machine (which is said to have had trouble with its transmission), the Deere car, No. 51 (which stripped its intermediate gear), Acme No. 43 (which damaged the rear axle), and Mitchell car No. 24 (which broke both front springs). The Thomas 40-horse-power runabout (No. 102) also arrived with a broken front spring.

In the tenth day's run of 140 miles, which was made at an average speed of 14 miles an hour, from Bedford Springs to Baltimore, Md., better roads were encountered, and, except for the water breaks and toll gates, better time could have been made. One more Glidden contestant lost its perfect score. This was the Stoddard-Dayton car No. 38, which was penalized 142 points on account of the delay due to transmission trouble. Ranier car No. 26, which was driven throughout the entire tour by Mrs. A. Cuneo, ran off the road and into a fence, owing to a front tire coming off. This car already had a broken front spring, and in the accident thus mentioned, the front axle was damaged and had to be repaired at a nearby blacksmith's shop. As the result of this trouble, the Ranier car received a further penalization.

The eleventh day's run of 174 miles, from Baltimore to Philadelphia, resulted in a broken rear axle for Haynes car No. 55, which for nine days had kept a perfect score. Welch car No. 7, which had been penalized 12 points on the first day only, for delay caused by hitting a bridge when trying to avoid striking a boy, and which on all subsequent days had a perfect score, was put out of the running by a broken crankshaft, though its mate, No. 29, was one of the perfect-score cars at the finish.

The final day's run, from Philadelphia to New York, a distance of 98 miles, was completed in 5 1-5 hours' running time, at the Court House in Jersey City. After being checked in, the cars crossed the ferry to 23d Street, New York, and paraded up Broadway to Central Park. A more mud-bespattered, dust-begrimed set of men and automobiles has seldom, if ever, been seen than the 55 cars which finally finished in New York city. Our illustrations show some of the perfect-score machines as they appeared in the line-up at Central Park, but these pictures, of course, give no idea of the hardships and terrible roads which were encountered and successfully overcome in this 1,570-mile tour. Several of the most marvelous performances were made by the small double-opposed-cylinder Reo and Maxwell machines, of 16 to 20 horse-power. That these little cars did successfully maintain the same fast schedule that was maintained by machines of more than double their horse-power, is

The Only Lady Driver, At the Wheel of Her 30-35 Horse-Power Rainier.

Mrs. Cuneo, despite the breakage of the springs and front axle of her car, brought it through to the finish.

View Showing Sprung Front Axle of One of the White Steamers.

No. 42 is the Royal Tourist which made a perfect score. Another car of this make completed the run on "filled" tires.

SOME OF THE WINNING CARS IN THE A. A. A.'S FOURTH ANNUAL TOUR AND CONTEST FOR THE GLIDDEN TROPHY.

indeed a high tribute to the perfection of the simple light-weight American car.

In going over the results of the tour, one is struck by the fact that there was relatively very little engine trouble on any of the cars. The same can be said of the radiators, which, with the exception of a few that were damaged in collision, did not spring any leaks. Structural weaknesses were the main weaknesses developed, and the ones which chiefly hampered the continuance of the cars in the run. The Autocar, for instance, first strained and then cracked its frame, while several cars broke their rear axles, and a considerable number encountered broken springs. No less than five cars stripped their gears, and the one gearless car, the Columbia gasoline-electric, as noted above, also had its transmission give out. One of our photographs shows a White steamer whose front axle was sprung. Notwithstanding such damage, three of these cars finished with a perfect score. Many of the drivers wished to equip their cars with shock absorbers after the first day's run, but this was not permitted. Several of the winners had these devices.

The 21 cars which finished with a perfect score consisted of four Pierce machines (three 40-45 4-cylinder cars and one 60-65 6-cylinder), two 60 horse-power Thomas Flyers, two 30-horse-power Peerless cars, two White steamers (a 30 and a 20-horse-power), and one each of the following: 50-horse-power Haynes, 50-horse-power Welch, 40-horse-power Walter, 40-horse-power Berliet, 45-horse-power Royal Tourist, 24-horse-power Premier, 25-horse-power American Mors, while a 30-horse-power White steam runabout and a 35-horse-power Stoddard-Dayton runabout were tied for the Hower trophy. A 6-cylinder Pierce runabout lost but 6 points on the ninth day. Three other contestants, a 35-horse-power Gaeth, a 40-horse-power Oldsmobile, and a 16-20-horse-power Maxwell, lost only 3 points throughout the entire test. When these facts are taken into consideration, it will be seen that fully half the cars that contested for the Glidden trophy finished with practically perfect scores. This was indeed a splendid showing, in view of the extremely difficult roads that had to be traversed in many places at the high average speed of about 18 miles an hour. In all probability, the tour will be more popular than ever another year; for, despite all the hardships which they went through, the tourists all expressed themselves as eager and willing to compete again. It is safe to say that no other form of competition gives a modern automobile such a terrible racking as a tour or endurance run of the character of this last Glidden tour, and only by such a test can the weak points of their machines be forcibly brought out and demonstrated to the automobile manufacturers.

A PRACTICAL GLIDING CRAFT WITH SUBMERGED HYDROPLANES.

(*Continued from page 76.*)

the quantity of water pumped into the tank, the cooling water is kept at the proper temperature. On account of the high compression, the best results are obtained with the water at a temperature below 180 deg. F. As each pair of opposed cylinders are in the same vertical plane, a four-throw crankshaft is used, the connecting rods of each pair of pistons being suitably jointed together at the crank. One of the rods is forked and attached to the crankpin bushing, while the other fits in between the fork of its mate and reciprocates upon the bushing. The engine is placed horizontal and oiled by splash lubrication.

A representative of the Scientific American recently witnessed a demonstration of Cooper Hewitt's gliding craft. As soon as the motor was started and the clutch thrown in, the craft shot forward, accelerating very rapidly until, after two or three seconds, the large planes left the water and the boat was entirely raised. It then ran on the four sets of lower planes at high speed and without any commotion, except when the upper planes happened to strike a wave, when the spray would be thrown in sheets, as shown in the photograph.

The force of the waves striking the emerged planes must necessarily have a decided retarding action upon the boat, and, as was explained to our representative, for rough water the craft should be designed to lift them higher above the water. The pressure of the waves when striking the emerged planes, while the boat is traveling at 30 miles an hour, is estimated to be 300 pounds to the square foot, which is also equivalent to the lift pressure on the submerged planes at the same speed. The blows received by the hull itself from the crests of the waves were sufficient to open seams, and drive water and spray into the boat. Of course, all this can be obviated by placing the step-like sets of planes farther below the hull, so that both it and the large upper planes will be lifted a foot or more above the surface instead of 3 or 4 inches, as at present. Such development will undoubtedly occur in the next craft that Mr. Hewitt builds.

According to the generally accepted formulas of Froude and others, the lift of a hydroplane increases or decreases as the square of the speed. Consequently, since the weight is constant, much less plane surface (about ¾ less) is required at 30 miles an hour than at 15, for example. Either that, or else a lesser angle of the planes can be used to accomplish the same purpose. To avoid complications and to obtain as accurate results as possible, Mr. Hewitt chose the former method and arranged to diminish the surface of the planes progressively by causing them to emerge step by step as the speed increased. As the lift per horse-power is better with large planes, such planes would be chosen were it not for the fact that the skin friction increases with the surface, and when large planes are used this becomes very great. Consequently a small or moderate-sized plane is preferable. The angle of the plane is another important factor. As the angle decreases, the surface of the plane (and consequently the skin friction) increases for any given lift. Naturally, there is a certain best angle with relation to the horse-power in each particular case. This angle is modified by the coefficient of friction of the material of which the plane is formed, and it must be such as to cause the minimum expenditure of energy for the required lift. It of course differs according to the material used in constructing the planes. In any case, the angle is relatively small, practically between 1 in 8 and 1 in 20 for the materials ordinarily used. An angle of 1 in 12 would probably prove to be about the right one in most instances. As the angle is relatively a small one, a small variation in it will produce a large variation in lift. In each experiment Mr. Hewitt preferred to keep the angle practically constant after the planes had been once set. This was done for purposes of level and equilibrium, and instead of changing the angle, the area of the planes was varied in the manner mentioned above. It would be feasible to vary the area of the planes mechanically if this were necessary, but it is simpler to take advantage of the surface of the water and to vary the surface of the hydroplanes by causing them to emerge step by step. Mr. Hewitt believes that varying the surface of the planes is essential, especially when it is desired to leave and return to the original supporting medium at such speeds as will be found safe in practice. Of course it is doubtless also practical to vary the angle of inclination of the planes if this is found necessary.

The weight of the Hewitt boat, together with the planes which emerge at full speed, is about 2,500 pounds. With two men and some 300 pounds of water aboard, the boat was lifted above the surface of the water at a speed of about 16 miles per hour, and a speed of over 30 miles an hour was readily attained, while the inventor believes that he has attained a speed of over 38 miles per hour. As the boat raised above the surface and the top of the propeller blades came within a foot thereof, the thrust was seriously affected and rapidly fell off. When the tips of the blades came close enough to the surface the engine would race for a moment till the boat slowed down and settled. This can be overcome by placing the propeller lower.

As the conditions were such that accurate observations were difficult to obtain, one could not tell with absolute accuracy by looking over the side of the craft at the various speeds just how far out the hydroplanes emerged, but Mr. Hewitt says that as far as he was able to judge, the craft was supported upon the four bottom planes when it was traveling at full speed, and that the other planes were above the surface. The combined surface of these four planes was about 8 square feet, so that the weight lifted per square foot was over 300 pounds. As no tests have been made of the horse-power the engine develops at the speed it was running, Mr. Hewitt does not state the horse-power that was required, though it is safe to say that this was slight in comparison with that which would be required to propel an ordinary boat at such speed.

As already stated, the lift of the planes tends to increase as the square of the speed, and the skin friction also tends to increase in the same ratio. At very high speeds, however, it is thought to be probable that the lift tends to increase in a greater ratio and the skin friction in a lesser one. If this is so, the increase in air resistance would be counterbalanced by this effect, and the horse-power required would tend to increase directly as the speed. Whether this is so or not cannot be determined until these very high speeds are actually attained.

The question naturally arises as to whether such a boat, supported as it is on four small planes, is stable. This can be answered in the affirmative, for, since each step in the system of hydroplanes is only a few inches in height, if the boat sinks at one corner due to any of its occupants changing their position, for example, it can only sink a few inches before another plane is lowered into action, and this, with the increased surface it affords, will quickly counterbalance the added local weight.

Comparing the usual surface hydroplane with the submerged type, it can readily be seen that although the supporting area of the former diminishes as the boat's speed increases, whereby only the rear third of the plane is made to carry the weight, nevertheless the front plane especially is subjected to terrific retarding blows when struck by a wave, and there is also trouble from interference of the planes. All this is obviated with submerged planes. It is also a well-known fact that the front third of a plane supports about one-half of the weight. The submerged hydroplane can be made so small, thin, and light that the resistance to advance of such a plane through the water is probably less than that of the large, cumbersome plane used on the surface, while the lifting power is far superior. As can be seen from the photograph, the planes that support Mr. Hewitt's 1½-ton craft are surprisingly small, which makes it seem probable that submerged hydroplanes suitable for large boats would not be unwieldy nor unpractical, while the hull required could be built strong and light and would serve simply as a means of flotation when the craft was at rest. It would certainly seem as if a great stride had been made in marine navigation by the successful demonstration recently made with Cooper Hewitt's novel craft.

The Use of Hydrolith for the Inflation of Balloons.

BY DR. G. F. JAUBERT.

All the chemical processes for the production of hydrogen which are at all suitable for use in the field are rather complicated. This is true both of the wet method, in which metallic iron or zinc is employed to displace and evolve hydrogen from dilute sulphuric or hydrochloric acid, and the dry method, in which calcium hydroxide (slaked lime) is decomposed by pulverized zinc at a high temperature. In practice the wet process is always used for the inflation of hydrogen balloons.

The reaction between the metal and the acid is affected by a number of conditions of diverse nature, and as the composition of the metal filings employed is far from uniform, it is found that, while some specimens act quickly upon the dilute acid, others remain almost passive, so that the disengagement of gas is extremely slow.

These objections, in addition to the consideration of weight, which is of paramount importance in field operations, led me to seek a chemical compound which would evolve pure hydrogen on simple contact with water, as calcium carbide evolves acetylene and oxylith evolves oxygen.

After long study of the question I turned to the hydrogen compounds of calcium, and in particular to calcium hydride, CaH_2, to which I have given the name of hydrolith. In marked contrast to oxylith, which yields only 150 liters of oxygen per kilogramme (2.4 cubic feet per pound) and calcium carbide, which produces from 280 to 300 liters of acetylene (4.6 to 4.8 cubic feet per pound), hydrolith gives a copious flow of hydrogen, amounting, if the compound is chemically pure, to 1,143 liters per kilogramme (18.3 cubic feet per pound).

The commercial hydrolith which we are now making and delivering to various governments for use in military ballooning, contains about 10 per cent of impurities and furnishes about 1,000 liters or one cubic meter of hydrogen per kilogramme (16 cubic feet per pound).

The large quantity of hydrogen produced by a small weight of transported material and the promptness with which the gas is disengaged make hydrolith preeminently suitable for the use of military ballooning, both for the initial inflation on the ground and for replacing lost gas without landing—a thing hitherto impossible.

Three types of military balloon have been adopted by the French central aeronautic station at Chalais-Meudon: The colonial balloon of a capacity of 350 cubic meters (12,350 cubic feet), the field balloon of 500 cubic meters (17,650 cubic feet), and the siege balloon of 800 cubic meters (28,250 cubic feet).

For the conveyance of compressed hydrogen for the inflation of colonial and field balloons (siege balloons being filled by stationary apparatus) the military authorities have adopted wagons, each of which carries 180 cu. m. (6,356 cu. ft.) of hydrogen compressed to 135 atmospheres in eight or ten steel tubes. The loaded wagon weighs 3½ tons and is drawn by six horses. Three wagons and eighteen horses are therefore required for the service of a field balloon.

It may be doubted whether this heavy and cumbrous equipment would render the service expected of it on the battlefield.

Gen. Langlois, in a recent excellent article on the German heavy artillery, asserts that even 2 tons is an excessive weight for a field vehicle, and cites experiences of the Austrian-Prussian and Franco-Prussian wars in support of his opinion.

What, then, can be accomplished with wagons weighing 3½ tons in the service of a field balloon station, which is essentially a portable observatory and should possess the same maneuvering qualities of lightness and mobility that are now demanded of field artillery?

Safety is another advantage of the employment of hydrolith. The transportation of highly compressed gases requires special precautions, and is subjected to elaborate and rigid regulations by railway companies. In war these great tube wagons would be easy marks for the enemy, and if a tube charged to 135 atmospheres (210 in Italy) should be hit by a shot, it cannot be doubted that its explosion would involve that of all the other tubes in the vicinity. The balloon station would be annihilated, and a large area swept clean by the explosion of so tremendous a mine.

No such accident is possible with hydrolith, which is as harmless as a mass of pebbles until its hydrogen has been liberated by the action of water.

The manufacture of hydrolith comprises two operations: the preparation of metallic calcium, and the combination of the metal with hydrogen. The metal is obtained by the electrolysis of fused calcium chloride. About 300 kilowatts of electrical power (7,800 amperes at 40 volts) produce 100 kilogrammes (220 pounds) of metallic calcium in 24 hours. Commercial electrolytic calcium is furnished in cylindrical ingots of a few pounds' weight, which are slightly oxidized on the surface, are very hard and brittle, and give a clear metallic tone when struck. When polished the surface has a white silvery luster. The density of the metal is 1.85, its melting point 760 deg. C. (1,400 deg. F.). It scratches lead, but does not scratch Iceland spar. The hydrolith is prepared by exposing metallic calcium to a current of hydrogen in horizontal retorts heated to a high temperature. The calcium gradually aborbs the gas, and is soon converted into calcium hydride, or hydrolith.

Chemically pure hydrolith forms a white crystalline mass, of the density 1.7, which has no known solvent. It dissociates when heated to 600 deg. C. (1,100 deg. F.). Commercial hydrolith occurs in irregular lumps of a slate gray color. Its impurities, which amount to about 10 per cent, consist chiefly of oxide and nitride of calcium.

The reaction which takes place when hydrolith is mixed with water is indicated by the following equation:

$$CaH_2 + 2H_2O = Ca(OH)_2 + 2H_2$$

Hydrolith Water Slaked lime Hydrogen

From this equation it may be calculated that 1 kilogramme of pure hydrolith evolves 1,143 liters of hydrogen, measured at the ordinary atmospheric pressure and temperature. The 10 per cent of impurities in commercial hydrolith reduces the yield of gas to about 1 cubic meter per kilogramme, as was stated above.—Translated for the SCIENTIFIC AMERICAN from La Revue Génerale de Chimie Pure et Appliquée.

Nicotineless Tobacco.

Upon an American request, Consul-General Frank H. Mason, of Paris, has prepared the following report on the introduction of "nicotineless tobacco" in France:

What is popularly known as "Caporal Doux," or the so-called "nicotineless tobacco"' in France, is simply ordinary caporal tobacco which has been treated by washing with water until the ordinary proportion of 2½ per cent of nicotine has been reduced to 1 per cent. In this form it is used for smoking in pipes and for the manufacture of cigarettes, which find a certain favor among smokers who prefer a light flavor or who, by reason of nervous or cardiac weakness, are wary of nicotine.

Ordinary caporal is a mixture of French, American, and oriental tobaccos, prepared by the "Régie," or government establishment, which has a complete monopoly of the manufacture of tobacco, cigars, and cigarettes in France. It has a somewhat rank, but not unpleasant flavor, and is the cheapest, most popular form of tobacco used in France for smoking purposes.

About eight months ago the French government, finding that there was a growing demand for a so-called "nicotineless tobacco," which had been made on a small scale by certain druggists, and which was also manufactured in Belgium, began the manufacture of a similar product by denicotinizing caporal tobacco through the action of water, which, in reducing the proportion of nicotine from 2½ to 1 per cent also washes out other ingredients, so that the weight of the tobacco is reduced, according to the quality of the leaf, from 15 to 30 per cent. It is this loss of weight rather than the actual expense of the process which constitutes the cost of denicotinizing and explains the fact that ordinary caporal tobacco, which sells at $2.41 per kilo (2.2 pounds), is advanced in value when denicotinized to $3.08 per kilo. The process of washing is simple, and is facilitated by the use of automatic machinery, but it requires careful and constant supervision by a skilled and trustworthy operator in order that a uniform product, containing the specified percentage of nicotine, may be obtained. "Caporal Doux" is retailed at the government tobacco shops in packages of 50 grammes for 80 centimes, or 16 cents per package, equal to about $1.46 per pound avoirdupois.

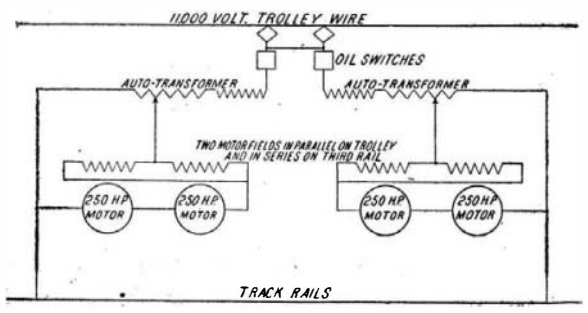
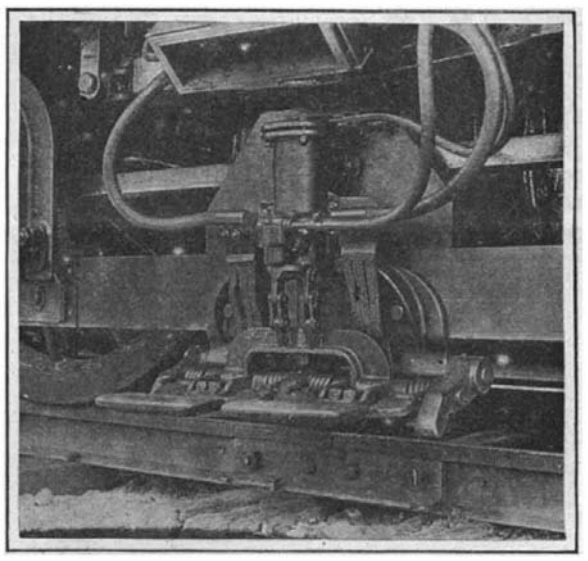


Diagram Showing the Wiring of the Locomotives.

Cigarettes of the same tobacco are sold in packages of ten each for 35 centimes, or 7 cents per packet, whereas ordinary caporal cigarettes of the same number and size retail for 30 centimes, or 6 cents per packet.

It is too soon to form any conclusion as to the extent to which denicotinized tobacco and cigarettes may be used in this country. It is now on sale in Paris, and in eighty other municipalities throughout France. During the four months from January 1 to April 30 there were sold by the Régie to dealers in Paris 26,000 kilos of denicotinized tobacco, and 5,000 kilos, or 50,000,000 cigarettes, made from the same material. To smokers accustomed to full-flavored tobacco the smoke of Caporal Doux is somewhat insipid. Its one advantage is that 25 cigarettes made of it contain only the same amount of nicotine as 10 of ordinary caporal, and its narcotic action upon the heart and nervous system is proportionately reduced.



The Collector Shoes for Taking Current from the Third Rail. When Not in Use the Shoe is Drawn Up Clear of the Rail by the Compressed-Air Cylinder Shown Above the Shoes.

"Touching Up" Faulty Places in Electroplated Coatings.

It often happens that articles which have been electroplated show spots that are badly or not at all coated. This is caused by imperfect cleaning, by the adherence of particles of dirt, contact of two articles in the bath, or by the wires which are used to hang the articles. No matter what the cause, the result is the same—an imperfect coating. To replace the entire article in the bath and let it stay there the requisite time for plating as at first would be a great loss of time, and would also be expensive. As sometimes it is only necessary to give the faulty spots a light coat, it is well to have a process by which they may be "touched up" without an entire repetition of the ordinary process. Sometimes these faulty places are not discovered before polishing the articles; in this case they would have to be cleaned again most carefully, before being put into the bath. Sometimes it has been found necessary to remove the entire coating, before starting over again.

A process which will enable the defective places to be covered is as follows:

First there is provided a sponge dipped in the bath liquor. The article on which there are faulty places in the plating is connected by a suitable conductor with the dynamo in the same manner as though it were lying in the bath. Around the sponge there is wound, as anode, a thin strip of the metal which is to be deposited. The entire arrangement then represents the conditions of the ordinary bath; and the current being turned on, the local plating can take place by the mere application of the sponge to the faulty places.

The German journal which describes this process (Deutsche Metall Industrie Zeitung) states that the process is admirably adapted to plating with silver, gold, copper, and brass; but that with nickel the results are far from being satisfactory.

The necessary apparatus consists of a pipe of glass or other material which does not conduct electricity, and on one end of which is placed the sponge; at the other end there is a rubber bulb containing some of the bath liquor. Through the bulb and the tube passes a rod which at the outer end of the tube ends in a clamp, so that the sponge and anode may be readily attached. On the other end of the rod, inside the glass tube, is fastened the anode rod, reaching into the sponge. The best material for this rod is platinum, so as not to be attacked by the bath liquor.

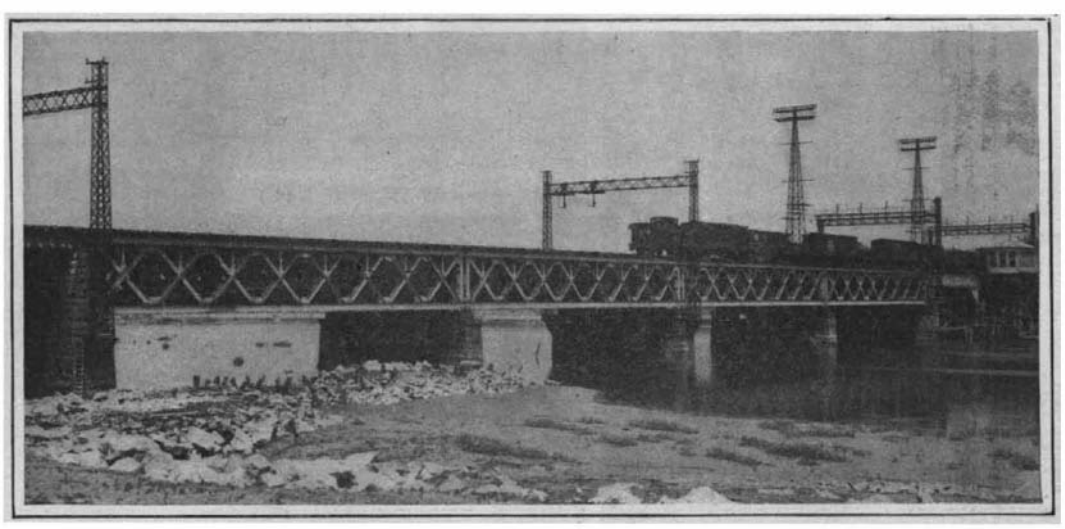
The operator's hands do not come into contact with the solution. Pressing the bulb causes a supply of bath liquor to penetrate the sponge, replacing what is used up in the plating process.

THE INAUGURATION OF THE NEW HAVEN RAILROAD ELECTRIC SERVICE.

Because of the fact that the inauguration of electric service on the New Haven system marks the first application of an alternating current system to the operation of a trunk line railroad in this country, the event will necessarily command widespread attention. It is true that the alternating current has been so used for several years in Europe, notably on the Valtellina line in Italy. In this country, also, single-phase current has been in successful operation on certain interurban lines. The New Haven Railroad equipment, however, is the first instance of the application of single-phase traction to an important trunk railroad; and the fact that throughout the whole of the 22-mile electric zone, the road is equipped with four tracks, and carries an unusually heavy suburban and express service, gives this service an importance equal to that which attaches to the third-rail equipment of the New York Central lines, which has now been in successful operation for over six months. The electric zone of the New Haven system extends from Stamford to Woodlawn, a distance of 22 miles. From this point to the Grand Central terminal station in New York, the trains run over the tracks of the New York Central Railroad.

THE COS COB POWER STATION.

The electric zone, throughout its entire length, is served from a power station located on the water front at Cos Cob, some three and a half miles from Stamford, Conn. The site selected is a picturesque point of land, which was formerly the summer home of the celebrated tragedian Edwin Booth. The architectural treatment of the building is simple and dignified, and harmonizes well with the natural features of the site. Unlike many of the later power stations, the structure rises only one story above ground level; although there is a deep excavation below the engine and boiler rooms for the accommodation of the coal bunkers and various auxiliary machinery. The boiler house occupies the westerly portion of the building, while the easterly bay is given up entirely to the turbines and generators. The whole build-

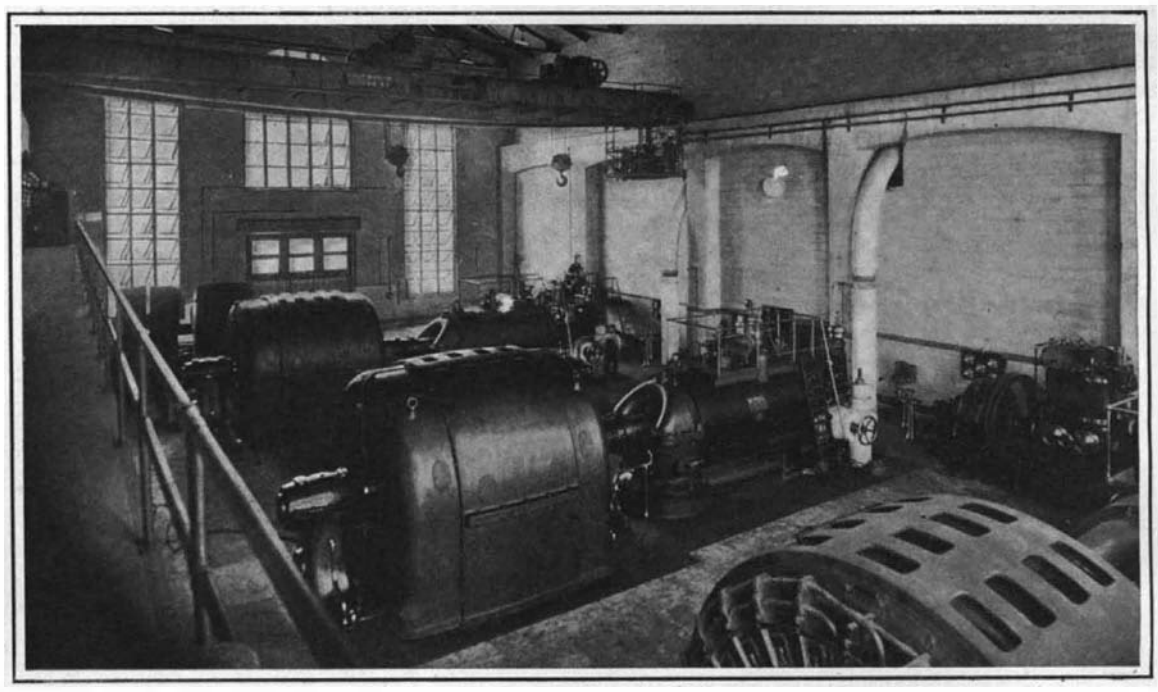


Cos Cob Bridge, Showing the Tall Towers for Carrying the 11,000-Volt Transmission Lines Over the Rolling Lift Bridge.

INAUGURATION OF THE NEW HAVEN RAILROAD ELECTRIC SERVICE.

ing is abundantly lighted, and all the windows, from top to bottom, are provided with swinging sashes, with a view to providing ample ventilation. The boiler house is equipped with sixteen Babcock & Wilcox boilers of 520 horse-power each. The coal is delivered at a wharf situated at a distance of about 400 feet from the power station. Here it is lifted from the barges and delivered to the top of a receiving tower, where, after being crushed, it is delivered to the cars of an inclined cable system, which runs from the tower to the roof of the boiler house. It is then delivered into a hopper, and taken away by a flight conveyer, either direct to the boilers or to the bunkers in the basement of the building. From the bunkers it is taken by a bucket conveyer and returned to the flight conveyer for transport to the boilers, where it is delivered direct to the Roney mechanical stokers in the furnaces.

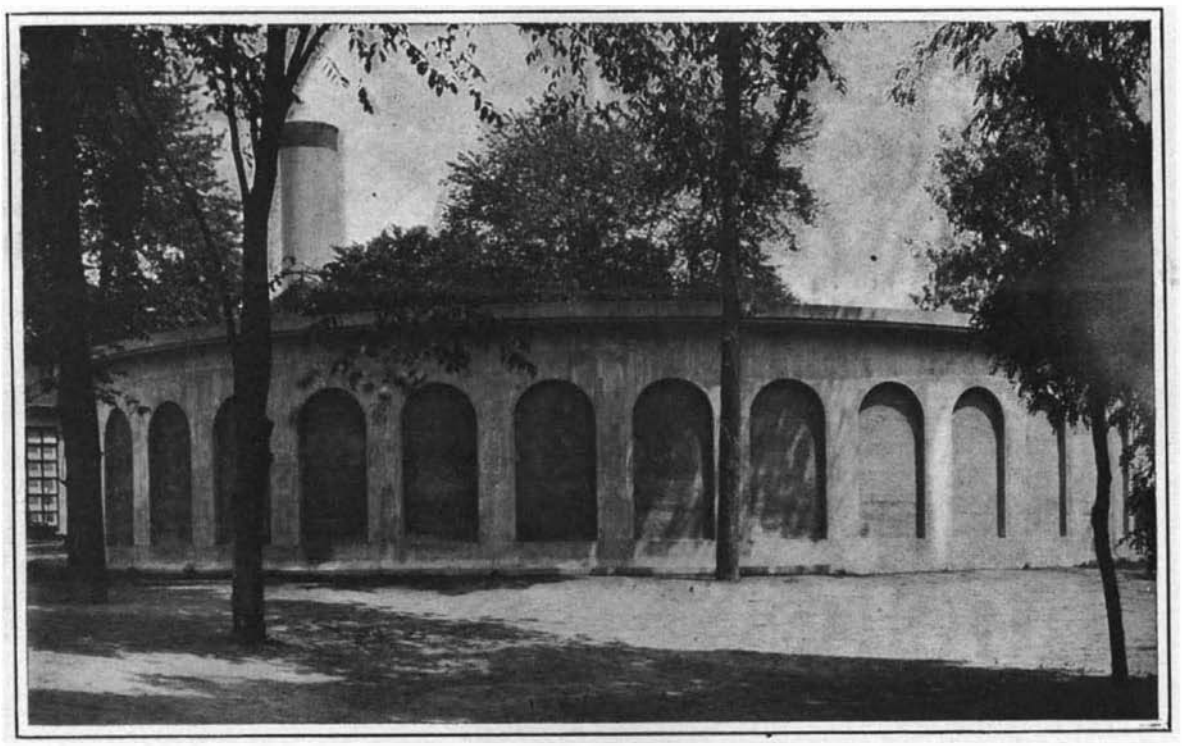
The engine room contains four 3,750-kilowatt turbo-generators of the Westinghouse-Parsons type. The turbines receive the steam at 200 pounds pressure and 100 degrees of superheat. They run at 1,500 revolutions per minute, and deliver single-phase current to the trolley system under a tension of 11,000 volts. The engine room equipment also includes two 13-inch Westinghouse compound steam exciters and one motor generator set exciter. The turbo-generators are among the latest built by the Westinghouse Company, and they are splendid specimens of the engine builder's art. In spite of the fact that the rotating parts of each set weigh 56 tons, and that the speed of revolution is 1,500 per minute, there is practically no vibration.



Interior View of Power Station ; Showing Three of the Four Turbo-Generators.

THE OVERHEAD TROLLEY SYSTEM.

The construction of the overhead trolley line is unquestionably the most novel feature of the New Haven Railroad equipment, at least from a constructive point of view. It was realized, when designing the system, that in view of the high speed of many of the trains, which frequently reaches from 70 to 75 miles an hour, it would be necessary to provide a trolley wire which would remain in true line and level, as distinguished from the loose and swaying wires of the ordinary trolley-car service. The system is built as follows: At about every 300 feet, the tracks are spanned by heavy latticed bridges erected upon massive concrete foundations. The bridges consist of two end posts and a deep latticed truss spanning the entire width of the tracks. The wires of the transmission line and signal service are strung upon the posts, and the four catenary trolleys are hung from the trusses. Each catenary consists of two half-inch steel "messenger" cables, which are cradled in the same way as the cables of a suspension bridge, and from these, and midway between them, is suspended a ⅜-inch copper trolley wire, the attachment being made by a series of triangles, which decrease from 6 feet on a side at the trusses to 6 inches at the center of each span. The triangles are formed of ⅜-inch galvanized pipe, and they serve to hold the copper wire firmly in alignment and level. At intervals of two miles the place of the ordinary bridge is taken by a special tension bridge of much heavier construction—sufficiently heavy to enable it to take up the slack of the wires when adjustment of that kind is necessary. Upon these bridges, also, is carried a set of section brake switches for cutting out the two-mile section of the road which they serve. One of our illustrations shows a bridge of this kind, as viewed from the entrance to the Cos Cob railroad bridge. To the left is shown a tall tower, from which the feeder lines are carried across the tracks to the power station. Another view, taken from the floor of the section brake switch bridge, gives an excellent view of the switches, which are here shown in the open position. When the switches are closed, the hinged cover serves to protect the whole mechanism from the weather.

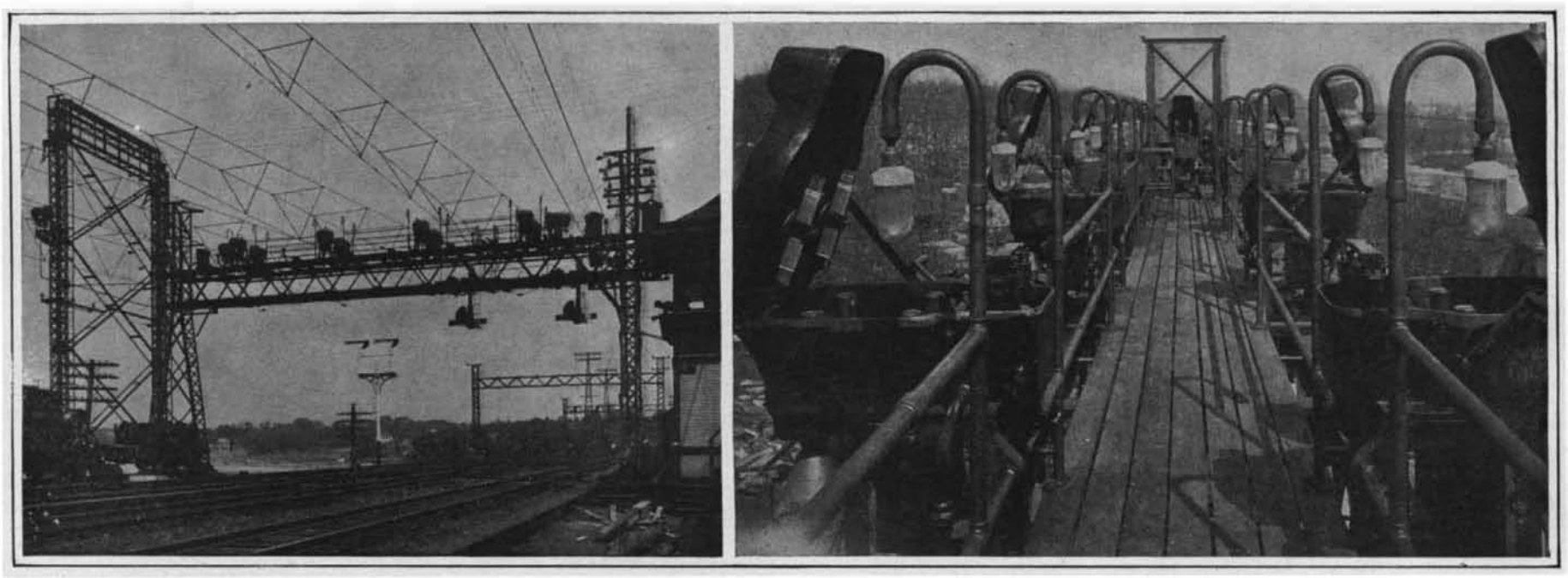


The Ferro-Concrete Condenser Water Tank.

From the foregoing description and the illustrations, it will readily be understood that the overhead trolley line construction is of a very costly character, and as a matter of fact, the average expenditure for this work has worked out at about fifty thousand dollars per mile.

THE ELECTRIC LOCOMOTIVES.

One of the chief economical advantages of the use of the alternating-current system is that it is not necessary to build, at stated intervals along the railroad, the costly sub-stations which form a necessary part of a direct-current installation. Instead, the stepping down of the current is done by transformers carried upon the locomotives. The provision of these transformers, of which there are two for each locomotive, adds greatly to the weight, which, in the case of the New Haven, reaches the high figure of 95 tons, although the rated power is only 1,000 horse-power. This is about the same weight as that of the New York Central direct-current locomotives, which have a normal rating of 2,200 horse-power. An interesting feature in these machines is that they have been arranged to take either single-phase current from the overhead line, or direct current from the third rail;



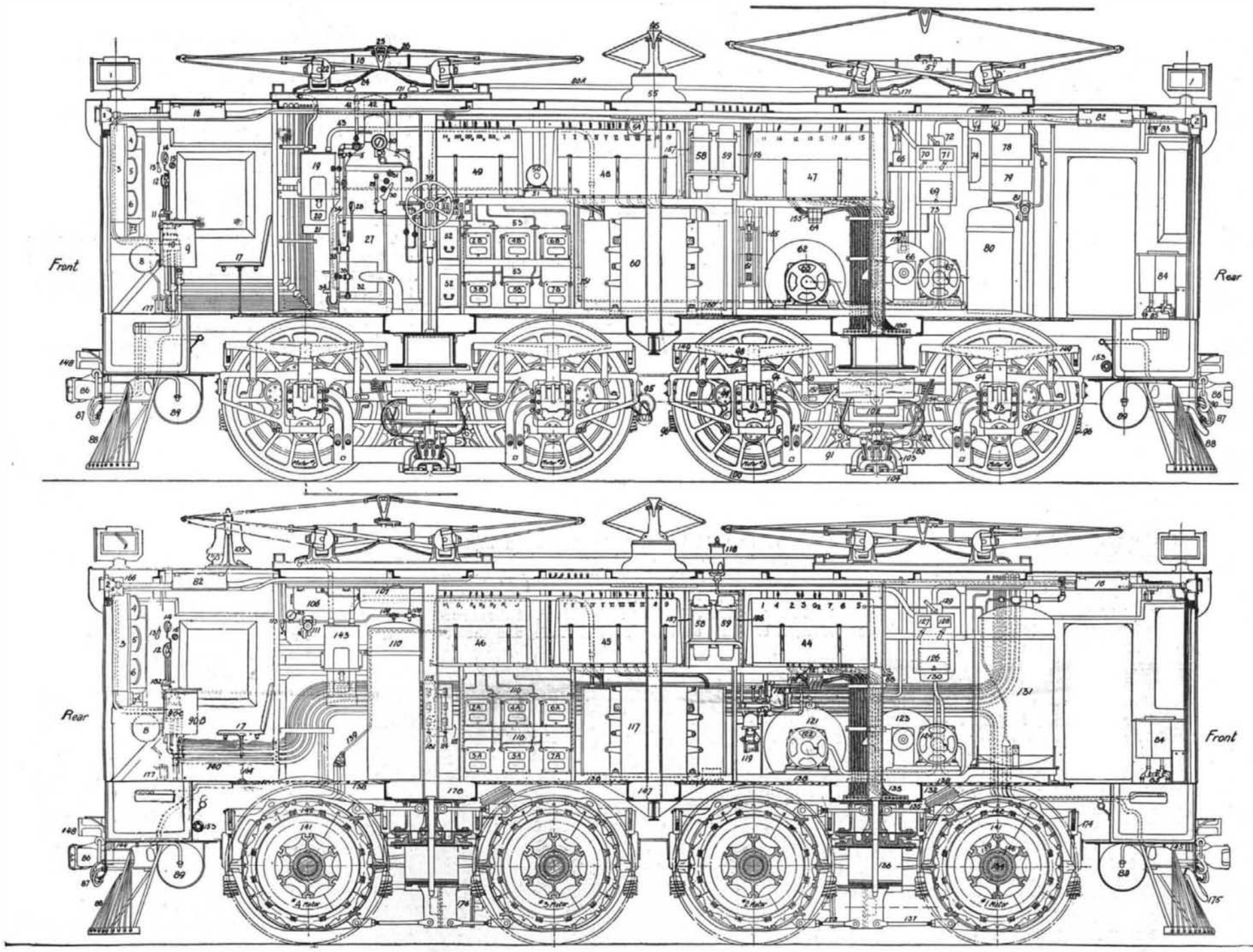
A Bridge Carrying the Section Break Switches for Cutting Out a Two-Mile Section of the Line.

Set of Section Break Switches Shown in the Open Position.

INAUGURATION OF THE NEW HAVEN RAILROAD ELECTRIC SERVICE.

and with a view to making our readers familiar with the internal construction, we present two sectional views with numbered references, covering the whole of the internal construction.

The locomotives are carried upon two four-wheeled trucks, and are provided with four 250-horse-power motors, one to each axle. The motors are of the compensating gearless type. They are suspended from frames, which fit over the trucks and rest upon the journal boxes, the motors being supported on four bolts provided at their lower ends with coiled springs. The armature is not directly connected to the axle of the truck, but is mounted on a quill which surrounds the axle, which it clears by ⅝ of an inch. Upon this quill are mounted the bearings of the wheels. The quill is formed with a wide flange at each end, and projecting from the face of each flange is a series of stout pins, which engage a series of pockets formed in the hub of the adjoining wheel. A series of coiled springs is interposed between the pins and pockets, which serve to transmit the power from the motor to the wheels without jar. Similar springs are disposed between the ends of the pins and the bottom of the pockets. This construction provides for a certain amount of vertical and lateral movement, while the motor is centered axially by the compression of the springs between the end walls of the pockets and the flanges of the quill. In order to prevent the motors from pressing against the wheels under the action of centrifugal force on curves, they are arranged to bring up against rails mounted on the truck frames. With the exception of the driving wheel axles and journal boxes, the entire locomotive is spring-supported. Particular attention has been paid to the ventilation of the motors. To this end, the channel beams, which form part of the framework of the car, are made to serve as conduits, through which air is driven, by means of a fan in the cab, to the motors and transformers. The air current, in addition to carrying off the heat generated by resistances, also serves to keep the motor free from dust. Each locomotive has been designed of sufficient power to handle an ordinary local train of from six to eight cars at the service speed. For hauling the through express trains, two locomotives will be coupled up in tandem. It is estimated that in local service, a 200-ton train can be operated at an average speed of 26 miles per hour with stops about two miles apart, the maximum obtainable speed between stations being about 45 miles an hour.



1 Headlight
2 Train Line Receptacles, Type 444D-E & F.
3 Support for Mounting Meters.
4 Speed Indicator Meter.
5 D.C. Ammeter.
6 A.C. Ammeter.
7 Temperature Indicator Meter.
8 Equalizing Reservoir.
9 No. 1 Master Controller.
10 No. 1 Automatic Brake Valve.
11 No. 1 Independent Brake Valve
12 Duplex Gage—Main Res. & Train L.
13 Whistle Handle.
14 Single Pointe. Air Gage.
15 3-way Snap Switch in light circuit.
16 ‡ 1 Junction Box Type 427
17 Motorman's Seat.
18 ‡ 1 AC. Pantograph Trolley.
19 ‡ 2 Oil Circuit Breaker.
20 Overload Trip.
21 Oil Tank on Circuit Breaker.
22 Insulators for Pantograph Trolley.
23 Support for Pantograph Trolley
24 High Tension Cable from AC. Trolleys.
25 Pantograph Trolley Shoe.
26 Pantograph Trol. Lock Cyl.
27 Steam Heating Boiler.
28 Gage—Air Press. on Burner.
29 Water Gage.
30 Drain Cup.
31 Try Cocks.
32 Fire Door.
33 Burner.
34 Gold Car Co. Regulating Valve
35 Mason Regulating Valve.
36 Steam Line from Boiler.
37 Air Inlet to Fire Box.
38 Water Feed Regulator.
39 Hand Brake Wheel.
40 Steam Gage.
41 Safety Valve.
42 Stock for Boiler.
43 HT Conduit from Oil Sw.to Transf.
44 Switch Group No. 1 Type 259
45 Switch Group No. 2 Type 251E
46 Switch Group No. 3 Type 257A
47 Switch Group No. 4 Type 259
48 Switch Group No. 5 Type 251E
49 Switch Group No. 6 Type 257B
50 Motor Gen. Set for Battery Charging.
51 Base for Motor Generator Set.
52 Storage Battery.
53 ‡ 2 Set of Resistance Grids.
54 AC Integrating Wattmeter.
55 Base for DC Collector.
56 DC Collector.
57 ‡ 2 AC Pantograph Trolley.
58 Preventive Coil 100 V. 250 amp.
59 Preventive Coil 50 V. 500 amp.
60 ‡ 2 Transformer.
61 Main DC Switch.
62 ‡ 2 Blower Motor Fan Casing.
63 ‡ 2 Blower Motor.
64 Field Shunting Resist. ‡ 2.
65 Hand Air Pump for Raising AC Trolley.
66 ‡ 2 Air Compressor.
67 ‡ Air Compressor Motor.
68 Relay Magnet Valves Type 386D.
69 ‡ 2 Fuse Box.
70 Canopy Switch for ‡ 2 Blower Motor.
71 Canopy Switch for ‡ 2 Compressor Motor.
72 ‡ 2 Motor Control Cutout.
73 ‡ 2 AC DC Change Over Switch.
74 Relay Box.
75 Snap Switch for Cab Lights.
76 Snap Switch for Head Lights.
77 SPDT Switch for Light Cir.
78 Control Reservoir.
79 Cover for Resistance Grid.
80 Oil Tank.
81 Slide Valve Reducing Valve.
82 No. 2 Junction Box Type 427.
83 Signal Valve.
84 Sand Box.
85 Electro Pneumatic Sander.
86 Coupler.
87 Hose Couplings.
88 Pilot.
89 Main Air Reservoir.
90 Hook for Safety Chains.
90A Cable connecting AC Trolleys.
90B No. 2 Master Controller.
90C No. 2 Auto. Brake Valve.
91 Third-rail Shoe Beams.
92 Third-rail Shoe Bracket.
93 Journal Box.
94 Truck Frame.
95 Driving Mechanism for Speed Indic.
96 Motor Suspension Springs.
97 Spring Hanger.
98 Elliptical Springs.
99 Wheel Pocket Cover.
100 Main Driving Wheel.
101 Third-rail Shoe Cylinder.
102 Third-rail Shoe Fuse Box.
103 Main Casting for Third-rail Shoe.
104 Third-rail Shoe.
105 Bell.
106 AC DC Change Over Sw, Heater Circ.
107 Fuse Box Heater Circuit.
108 Gov. Valve for Emergency Contl. Resr.
109 Three-way Cock.
110 Emergency Control Reserv.
111 Slide Valve Reduc. Valve.
112 Balancing Transt. (back of ST DT Sw.)
113 Combined Strainer and Drain Cup.
114 SP DT Switch ‡ 1 Heater Circuit.
115 SP ST Switch.
116 ‡ 1 Set Resistance Girds.
117 ‡ 1 Transformer.
118 Whistle.
119 Governor.
120 Distributing Valve.
121 ‡ 1 Blower Motor Fan Casing
122 ‡ 1 Blower Motor.
123 ‡ 1 Air Compressor.
124 ‡ 1 Air Compressor Motor.
125 ‡ 1 Field Shunting Resist.
126 ‡ 1 Fuse Box
127 Canopy Switch for ‡ 1 Blower Motor.
128 Canopy Switch for ‡ 1 Compressor Motor.
129 ‡ Motor Control Cutout.
130 ‡ 1 AC DC Change Over Switch.
131 Water Tank.
132 Air Connection to Motors.
133 Motor Leads for ‡ 1 and ‡ 2 Motors.
134 Axle of Main Driv. Wheels.
135 Upper Torque Rod.
136 Center Pin.
137 Lower Torque Rod (long).
138 Trap Doors over Motors.
139 Heater Circuit Leads.
140 Air Brake Piping.
141 Armature ‡ 130 Motor.
142 Field Frame ‡ 130 Motor.
143 ‡ 1 Oil Circuit Breaker.
144 Bus Line Socket Heater Circuit ‡ 2 Sw.
145 Bus Line Socket Heater Circuit ‡ 1 Sw.
146 Quill.
147 Tool Box.
148 Bumper Block.
149 Motor Suspension Cradle.
150 Spring Hanger.
151 Equalizer Spring.
152 Brake Shoe.
153 Steam Line.
154 Equalizer Bar.
155 Series Transf. for AC Amm ‡ 3 & ‡ 4 Motors.
156 Preventive Coil 100 V. 250 amp. (back of ‡ 59).
157 Permanent DC Fld Sw. Grid (back of ‡ 58).
158 Ser. Transf. for AC Amm. ‡ 1 & ‡ 2 Motors.
159 Armature Spider.
160 Air Inlet to Transformer.
161 Air Inlet to Resist. Grids.
162 Third-rail Shoe Leads.
163 Gage Control Line Pressure.
164 Support for Motorman's Seat.
165 DC Wattmeter.
166 Blind Lights.
167 DP DT Switch for Battery.
168 DP DT Switch for Battery.
169 SP ST Switch for Motor Gen. Set.
170 Snap Switch for Motor Gen.
171 Insulators Supporting AC Trolley Cable.
172 Shunt for DC Ammeter Motors 1 & 2.
173 Lower Torque Rod (short).
174 Motor Suspension Hanger.
175 Steam Hose Coupling.
176 Brake Cylinder.
177 Foot Push Button Switches.
178 Air Conduit.
179 Shunt for DC Ammeter Motors 3 & 4.
180 Motor Leads for ‡ 3 & ‡ 4 Motors.
181 SP DT Switch ‡ 2 Heater Circuit.
182 No. 2 Independent Brake Valve.
183 Third-rail Shoe Unlock Cyl.

Longitudinal Sections, Showing the Internal Construction of the New Haven Electric Locomotives.

INAUGURATION OF THE NEW HAVEN RAILROAD ELECTRIC SERVICE.

The service was opened on Wednesday, the 24th of July, by the operation of all the local trains, twelve in number, running between New Rochelle and New York. In two weeks' time service will be extended to include the Port Chester locals, of which there will be twenty-three. Soon after that, the Stamford local service will be added; and, finally, the express service will make the change from steam to electric locomotives at Stamford; after which no more steam locomotives will enter the Grand Central Station.

AN IMPROVED ELECTRIC WELDER.

BY A. FREDERICK COLLINS.

Welding is one of the most important and at the same time one of the most difficult operations in the manufacture and use of metals.

Until the recent introduction of welding by electricity, little progress was made in the art during the past thousand years, yet reliable welds were more and more needed as the manufacture of metals and alloys improved and higher working stresses were demanded.

Welding is the operation of uniting two or more pieces of metal by heating the surfaces required to be joined, and forcing them together either by hammering or other pressure while the metal surfaces are in the plastic state. A perfect weld might be defined as one in which the metal at and near the weld remains equal in strength and ductility to those parts of the metal which have not been heated.

In the ordinary process of welding two pieces of iron, the smith heats the ends in a fire until, so far as he is able to judge, the temperature has become somewhat higher than the correct welding point. The ends are then placed together, treated with a flux—such as borax—which melts and quickly covers the heated surface, thus preventing the further access of air, and, at the same time, reduces the oxide scale already formed to a liquid state; the smith then hammers the two ends together, his aim being to force out from the surfaces in contact all the burnt iron and all the flux, and also to produce a smooth round surface. The strength of the weld depends almost entirely upon the skill which has been exercised in bringing the metal to just the right temperature, and in hammering out all the burnt metal and flux.

The welding of brass, copper, and some other metals is impracticable by the old hand method, since copper would need to be raised to a very high temperature, as compared with iron, and it is then highly oxidizable, and liable to form a scale difficult to treat by any flux; it also passes quickly from the solid to the molten state, and is brittle near the welding temperature; while with brass it is difficult to avoid volatilization of the zinc before the copper constituent has been raised to the necessary temperature, and further, this alloy also becomes very brittle near the welding temperature. Heretofore such metals and alloys have been united by brazing or soldering—operations which require considerable skill, and are expensive in the matter of solder, fluxes, heating appliances, and labor charges.

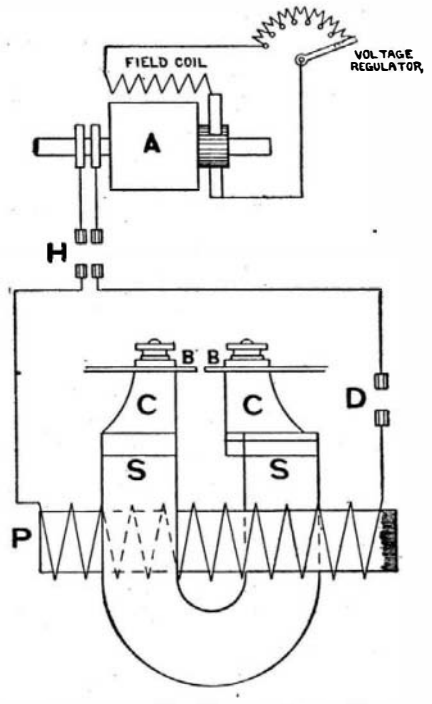
These metals and alloys can, however, readily be welded electrically, and, under certain conditions, a good weld can be made between two entirely different metals and alloys without difficulty. Welding by electricity is, in fact, capable of producing such astonishing results that it has revolutionized many manufacturing operations, doing away with highly skilled labor, increasing enormously the rate of production, while the final result is that more reliable work can be turned out at a fraction of the previous cost. The system adopted and the machines employed must, however, be suitable for the particular class of work to be done.

The Prescott welder shown in the illustrations is especially designed for welding wire and rods of comparatively small cross section, that is, it will weld wire of the smallest sizes up to rods of the following maximum sizes: iron and steel, ¾ inch in diameter; brass, 9/16 inch in diameter; and copper, ⅜ inch in diameter. Bars and strips of metal of any shape or section can also be welded, provided the sectional area does not materially exceed that of the equivalent areas for rods as given below.

Not only can copper, brass, and other metals and alloys which are unweldable by any other process be welded, but in the case of iron and steel an unskilled man or youth after a little practice, can produce welds far superior to those turned out by a highly skilled smith. Thoroughly sound welds can be made in copper with the utmost ease, and it is an important fact that brass can be readily and simply welded. Still more important is the fact that brass can be welded without destroying the structure given to it by drawing or rolling, and the welds will stand all the rolling and drawing processes necessary to work the material down to the smaller sizes, as will be explained.

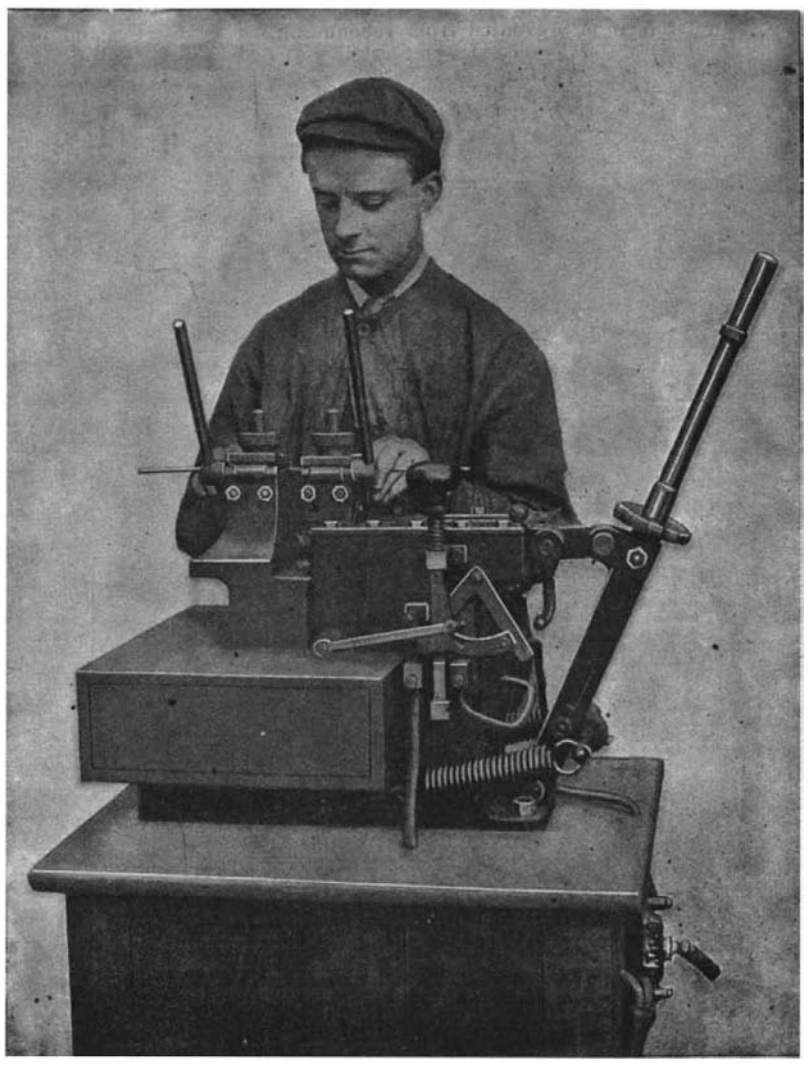
The system adopted in the construction of the welders is shown by the diagram, Fig. 1. *A* is an alternating-current dynamo, which can be connected by means of switches *H* and *D* to the primary coil *P* of the transformer. The secondary coil of this transformer consists of a massive single convolution *S S*, terminating externally in two large clamps *C C*, which grip the two rods or other pieces required to be welded together.

When the switches are closed the generator supplies a current of moderate strength at a pressure of, say, 100 volts to the primary coil *P* of the transformer. This current is transformed by electro-magnetic induction into a current of very low voltage but very great amperage, in the secondary coil *S*, and the heavy current so produced flows across the junction of the two pieces to be welded *B B*, their ends being kept in contact under moderate pressure.



THE CONSTRUCTION OF THE WELDER.

The electrical resistance in the secondary circuit being practically located at the two end surfaces, thus kept in contact, all the heat is developed at those surfaces, i. e. just where the weld is made, and the resulting increase in temperature by further augmenting the resistance at this point adds to the desired effect. A device is provided for regulating the pressure between the ends of the rods, since this pressure must be adjusted to the size of the rods and the plasticity of the metal at welding temperature. After a few seconds the metal begins to flow and the rods become perfectly united, the metal bulging out slightly around the joint, and at this stage the current is cut off by the switch *D*. The joint is now trimmed down by filing or by an emery wheel. The conditions for successful welding vary with different materials. With iron or steel it is necessary to keep the temperature below the melting point, to avoid injury to the mechanical properties of the metal, and consequently considerable pressure is required to make the weld. In the case of copper and brass, the pressure must be lighter; the metal is allowed to actually fuse at the junction, and the pressure should be only just sufficient to force out the burnt metal, the current being cut off at the moment the ends of the rods are forced together at the proper welding temperature. It is this forcing away of the burnt metal which enables such good results to be obtained with drawn brass rods.



AN IMPROVED ELECTRIC WELDER.

The full equipment for electrical welding consists of a generator, switchboard, cable, transformer, clamps, operating lever, and automatic switch. Where suitable electric power is not at hand, a special self-exciting alternating-current generator is furnished. The switchboard is of the usual type, and a heavy cable is supplied to connect the generator, switchboard, and welder. In the transformer the main casting of the welder forms the core of the secondary coil, making the machine mechanically sound and electrically efficient.

The clamps for holding the work are massive in construction, in order to prevent temperature rises in the machine itself. For very large work a water-cooling arrangement is provided. The operating lever is so designed that the position of the movable clamp can be varied and the pressure adjusted on the ends of the pieces required to be welded. There is an automatic switch, which enables the current to be utilized at the instant it is required, and which automatically breaks the circuit when the critical temperature is reached.

The Charcot Antarctic Expedition.

At the time of the first French expedition, organized and conducted by the eminent explorer, Dr. Charcot, the circumstances were such that the preparations had to be made within a short time, and the resources which were placed at the explorer's disposition were quite small and insufficient. Nevertheless, the scientific results of this expedition were considerable. Encouraged by this first success, and stimulated by the conviction held by scientists of all countries that there is an immense amount of work to be done in the regions of the Antarctic which are so little known, Dr. Charcot, not long after his return to Paris, decided to organize a new expedition. The Académie des Sciences then charged a commission composed of MM. Mascart, Perrier, and Bouquet de la Grye, to draw up a report upon the results of the first expedition and upon the utility of a new one. Following the reading of this report, the Académie decided that it would be of great scientific value, and placed the project under the patronage of a commission composed of leading scientists, with instructions to lay out the scientific part of the programme for the new expedition. The work will bear upon the questions of geography, physics of the globe, including gravitation, magnetism, meteorology, atmospheric electricity, tides, etc., also astronomical work, zoology, palæontology, geology, bacteriology, and other branches. Data from the Antarctic regions are now wanting so as to be able to co-ordinate the observations upon physics of the globe and especially atmospheric electricity and meteorology taken at different points. It is hoped that this want will be supplied by expeditions such as the present one, and that by elucidating the problem of the existence of a permanent cyclonic or anticyclonic regime over the immense ice surface of the polar cap, we may be able to predict great atmospheric disturbances, to avoid or lessen cosmic disasters and to protect agriculture and navigation. On the same order of ideas, the knowledge of the densities of sea water, of ocean currents, habitat and migrations of fauna, will facilitate the fishing industries and whale hunting in these regions. The estimated cost of the expedition is $150,000. Private subscriptions will no doubt furnish one-fifth of this amount, and there will remain for the government the sum of $120,000. Half this credit will be needed during the present year for the preparatory work of the expedition, especially for building a special vessel which will be required. Upon the assent of the Minister of Public Instruction and the Minister of Finance, the government has just allotted a credit of $60,000 for the preliminary work.

The navigable dimensions of the Suez Canal are now practically double what they were twenty years ago, the superficies of the vertical profile having been considerably increased.

THE NEW VICKERS-MAXIM AUTOMATIC RIFLE-CALIBER GUN.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The attention of European naval and military authorities has recently been centered in the new automatic rifle-caliber gun that has been designed by Messrs. Vickers, Sons & Maxim, Limited, and by whose courtesy we are enabled to describe and illustrate the many important improvements that have been embodied in this arm. It will be seen that fundamentally the principle and design are the same as the famous light Maxim gun, the main difference being that a reduction of 33 per cent in the weight of the weapon has been effected by the extensive utilization of high-class steel and aluminium, as a substitute for the gun metal hitherto employed. Moreover, a great improvement in the firing accuracy has been insured by means of a new-pattern muzzle attachment, the purpose of which practically eliminates the accumulation of fouling, and enables the gun to be fired continuously without losing any time in cleaning out the barrel, as is essential in the original weapon.

The water jacket is made of thin corrugated steel tubing, whereby great girder strength combined with lightness is procured, in addition to the provision of a larger cooling area. The trunnion block is made of steel, and has the advantage of being much lighter in weight; while the same fact applies to the end cap. The feed and handle block are made of high-class aluminium alloy with the working parts of steel as in the original gun. The trigger bar is made of steel, and is of a much improved pattern, making it impossible for any debris to remain in front of the hand sear, so that it is absolutely impossible for the gun to be fired accidentally without actually pressing the trigger lever.

The gun is entirely automatic in its action, and is fed automatically with cartridges from a belt, and the firing being controlled at will by means of pressure applied to the trigger lever at the rear. The weapon consists of two essential features—the recoiling and the non-recoiling parts. The automatic operation is insured by two forces—the explosion of the charge, which forces the recoiling portion backward, and a strong spring known as the fuzee spring, which carries it forward.

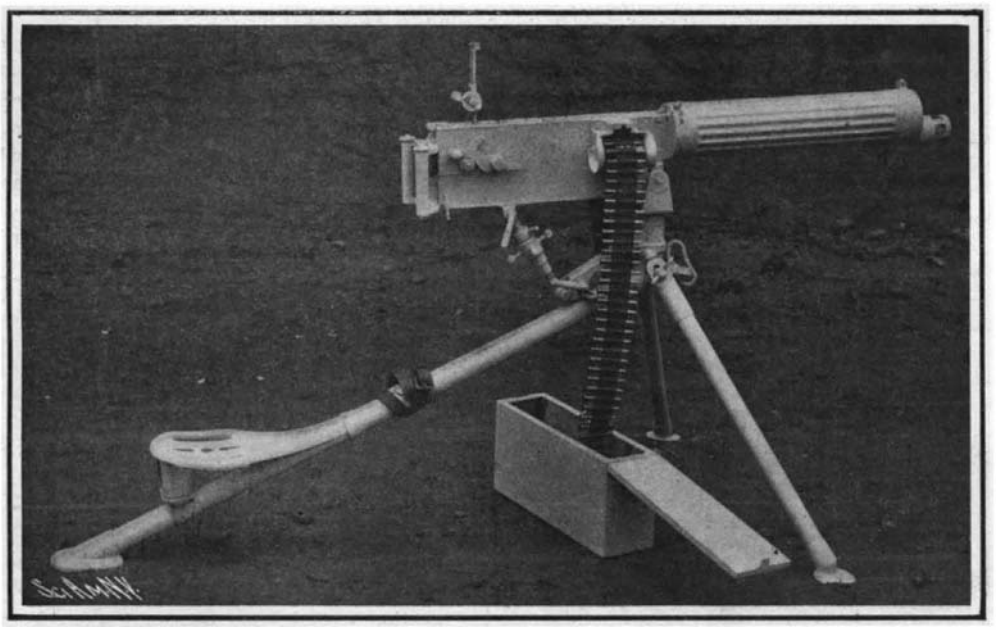
The recoiling portion includes the barrel and the firing mechanism, which move to and fro upon guides attached to the frame, the requisite motion being imparted by the recoil, the energy of which is stored up and regulated by means of the fuzee spring. The functions of the mechanism or lock are to receive the live cartridge from the belt, introduce it into the chamber of the gun, fire it, and then eject the empty shell.

The side levers are so constructed that when the lock is assembled, they cover the axis pins for the tumbler and hand sear, so that they cannot be shaken out. The advantage of this arrangement is that the necessity for securing the pins with wire is overcome. The side levers are not pivoted on studs to the sides of the frame, but are secured on an axis pin which passes through the frame and the longitudinal slot in the firing pin. There is a bayonet joint for attaching the side levers to the connecting rod, while an adjusting nut is placed on this connecting rod, so that the distance between the face of the extractor and the barrel may be adjusted.

The extractor levers, by means of a connecting pin, form one single piece, and are supported by bearings at the bottom on the lock frame. These levers support the extractor during the whole period of action, and at the same time limit its downward motion. The main spring is simply held in position by a recess formed in the lock frame without the aid of a pin. The extractor itself is only slightly different from that in the original gun, the lower lugs of the lever having been removed and the tail spring dovetailed in.

The recoiling parts are mounted inside the non-recoiling section, and are comprised of the barrel, the two recoil plates which carry the lock, and the crank. In order to protect the barrel, which is made of high tensile steel, from rust, it is coated with copper. The breech end is formed in the shape of a block having a stud on either side, called the barrel trunnion, and by means of which the barrel is attached to the recoil plates.

The crank is fitted on the right with a handle, the lower surface of which bears on the roller and is of special curved form. It is fitted with a fuzee, to which are attached two links which connect it to the fuzee spring, the remainder of the crank being within the breech casing. The action of the recoil causes



NEW VICKERS-MAXIM AUTOMATIC RIFLE-CALIBER GUN.

the fuzee spring to extend and wind the links, which are attached to it, about the fuzee, so that when the crank handle is immediately forward, the fuzee spring is not only extended about one inch by the recoil of the barrel, but is further extended by the winding of the links on the fuzee. Immediately the recoil action is expended, the fuzee spring pulls the recoiling portion back into the firing position. This movement unwinds the links from the fuzee, so that the crank handle flies back and strikes the check lever, which is so constructed that, when the crank handle reaches the stop, it is prevented from rebounding.

The non-recoiling portion comprises the frame and outer casing, including the water jacket which surrounds the barrel. The jacket is made of steel, and holds about seven pints of water for cooling the barrel during firing, being fitted with a valve to permit the steam thus generated to escape. The ejector tube is placed under the water jacket, and being fitted with a spring, prevents the shells from falling back into the gun during firing. When the jacket is filled with water, about 2,000 rounds may be fired at short intervals without replenishing the water supply. At the maximum firing capacity, the water commences to boil after about 700 rounds have been discharged.

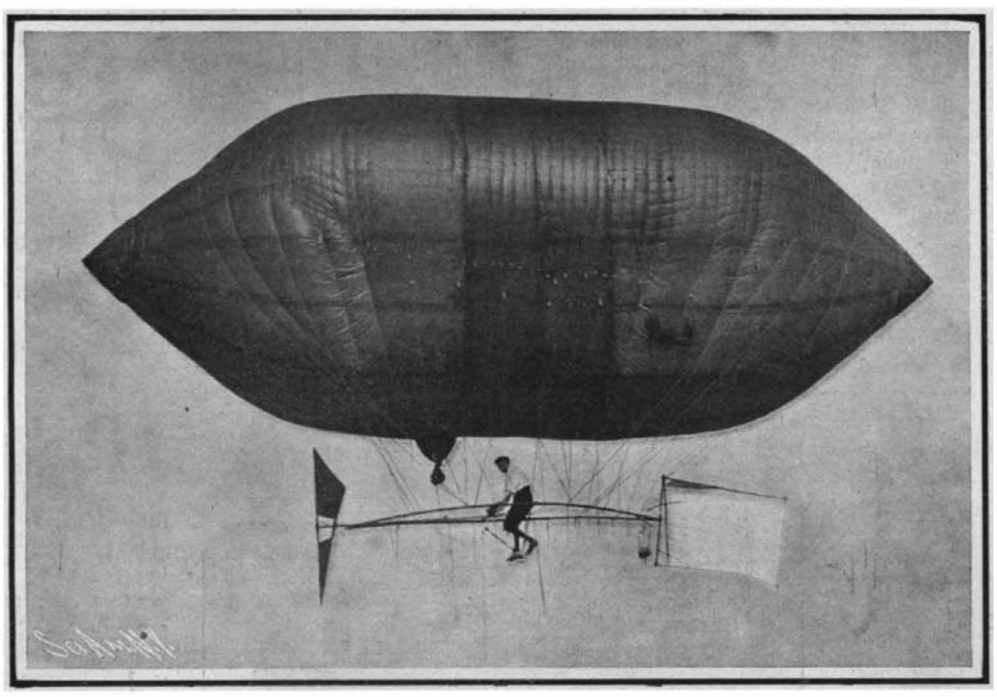
The gun is supplied with cartridges from a belt placed in an ammunition box on the right-hand side of the gun. The loaded belt is introduced into the gun by means of the feed-block, and as it passes through the cartridges are withdrawn by the action of the mechanism. On the top of the feed-block is a slide, which is made to move laterally by means of the cranked lever. Two pawls are fitted to this slide, held up by a spring. At each forward movement of the barrel these pawls push the belt one step to the left, placing a cartridge in position ready to be gripped by the extractor. On the under side of the feed-block are two retaining pawls actuated by a spring, which prevent the belt from slipping back; however, these pawls can be released by hand if it is necessary to withdraw the belt.

The muzzle attachment, which constitutes a prominent feature of this weapon, rendering greater accuracy in firing, consists of a disk clamped to the muzzle of the barrel, and a perforated sleeve which is connected to the barrel gland by a kind of bayonet joint, comprising a series of segmental lugs, which enables the sleeve to be rapidly and easily removed. The front part of the sleeve is concave, and the disk is cup-shaped, coming almost up to the front part of the sleeve when the barrel is fully home. In firing, the gases escaping from the muzzle are deflected by the cup-shaped disk, forcing the barrel to the rear after each discharge, and eliminating to a great extent much of the fouling accumulation.

The action of the gun is as follows: The gun is loaded, i. e. one cartridge is in the barrel, and another is in the belt in the feed-block immediately over the cartridge chamber. By pressing the trigger lever, the cartridge in the barrel is fired, and through the explosion the recoiling portion moves backward, the crank is rotated sufficiently to extract the empty case from the barrel, and a fresh cartridge from the belt fed into the feed-block. During the backward movement of the mechanism, the extractor drops down, bringing the cartridge in line with the chamber and the empty shell in line with the ejecting tube. The rotation of the crank unlocks the breech, draws the mechanism away from the barrel, and cocks the main spring. The mechanism returns, pushing a fresh cartridge into the barrel and the empty shell into the ejecting tube. Then, when the breech is closed, the extractor is moved upward, its grooves engaging with the next cartridge in the belt, and leaves the empty shell in the ejecting tube. By simply pressing the trigger lever, the gun will fire as long as any cartridges remain in the belt.

By the substitution of gun metal by aluminium and high-class steel, the weight of this weapon has been reduced to 40.5 pounds, whereas the standard automatic rifle-caliber Maxim gun weighs 60 pounds, representing a saving in weight of 19.5 pounds.

For use with this gun, a light tripod has been designed, the weights of all the component parts having been kept as low as possible consistent with stability during firing. Steel tubing is used for the front legs, there being at the upper end of each a longitudinal slot for attachment to the stud on the pivot, while a spiked shoe at the lower end prevents it from digging into the ground. When folded up, the front legs of the tripod lie alongside the rear leg, and are secured together with a strap. The rear leg is also a steel tube, the top end fitting into a socket at the rear of the pivot, with the lower end carrying a flat shoe to prevent it from sinking into the ground. There is a bracket and a collar on this rear leg for attaching the seat. The latter slips into the collar, and is secured to the seat bracket by two bolts. Thin steel plate is used for the seat, flanged and pressed into shape. To facilitate carrying the tripod, there is a longitudinal slot cut out at each side to form handles. Extensive trials with this mounting have shown, that notwithstanding its light weight, 29.5 pounds, as compared with the weight of the former type of tripod —49 pounds—great steadiness is obtained during firing. The appreciable economy that has been effected in the complete weight of this new weapon, which is only 70 pounds as compared with the 109 pounds of the standard service arm, insures greater mobility, and renders it highly serviceable both for naval and military operations.



THE "SKY CYCLE" BUILT AND NAVIGATED BY A FIFTEEN-YEAR-OLD BOY.

A HOME-MADE AIRSHIP.

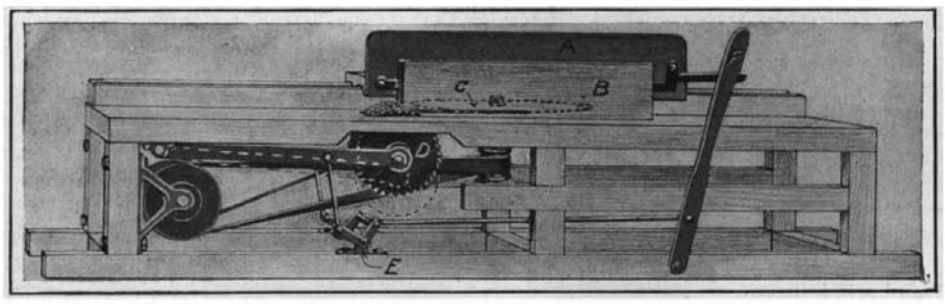
BY H. G. MOORE.

Inspired by the aeronautic exhibition at the St. Louis Exposition, Cromwell Dixon, a 15-year-old lad

of Columbus, Ohio, resolved to make some experiments along this line himself. With his mother's aid alone, he designed and built two airships, the last a slight improvement over the first. The boy's mother believed him too young to attempt to fly with a powerful motor, and he began on the idea of a foot-power machine. He calls it a "sky cycle." He secured a silk gas bag having much the form of a huge lemon, 32 feet long and 15 feet through. For this he designed and personally made a 4-inch mesh net. The bag he fills with hydrogen gas produced with home-made generators. Taking an ordinary bicycle, he removed the wheels and the forks, leaving only a triangular frame supporting the seat, the handle-bars, and the pedals and sprocket wheel. The latter he geared to rotate a two-bladed silk propeller. Behind the framework he placed a silk rudder with a bamboo frame, manipulated by means of cords running forward to the handle bars. The main frame of the airship is built of slender spruce rods. On this frame the mechanism is supported, and to it the gas bag is attached by means of the net. Young Dixon has succeeded in making successful ascents with his "sky cycle."

AN IMPROVED LATH CUTTER.

The accompanying engraving illustrates a machine adapted for cutting stock of a regular shape into

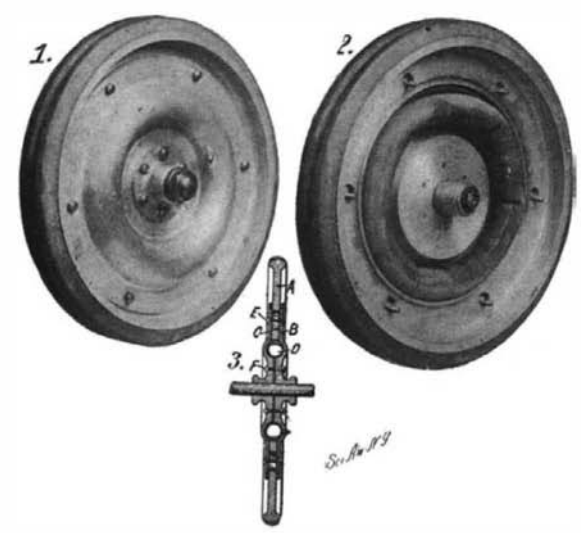


AN IMPROVED MACHINE FOR CUTTING LATHS.

laths. Briefly stated, the machine comprises a single horizontal saw adapted to cut a slab from the stock, and a series of vertical saws, which subsequently cut the slab vertically into a number of laths of the proper thickness. The stock may be of any irregular shape, provided one face is flat. The machine is formed with a carriage *A*, mounted to travel on guides over the saws. The stock *B* is supported by this carriage between a pair of jaws. One of these jaws is fixed, and the other, which is attached to a hand lever, is normally pressed against the stock by means of a spring. The horizontal saw is shown at *C*. This is set at the required height above the table of the machine, so as to cut the stock into slabs of a thickness equal to the width of the laths. Immediately back of the saw *C* is a gang of saws *D*, which operate on the slab as it issues under the horizontal saw *C*. The saws *D* are keyed to a common spindle mounted in a hinged frame, so that they may be moved up or down, according to the thickness of the slab on which they are adapted to operate. The hinged frame is connected by links to a pair of bell-crank levers *E*, which, in turn, are connected to a hand lever *F*. By moving this hand lever the saws may be raised or lowered, as desired. It will be understood that in feeding the stock to the saws, the carriage is moved by hand along the guides. A patent on this improved lath cutter has recently been granted to Mr. Herschel Oldham, of Deland, Volusia County, Fla.

IMPROVED VEHICLE WHEEL.

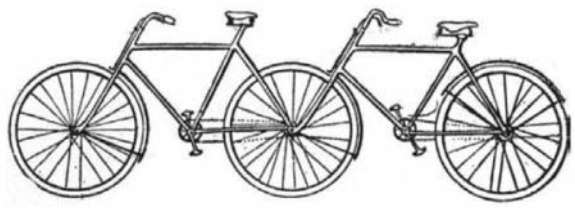
Instead of placing the pneumatic tube of an automobile wheel on the tread, where it is most subject to wear and is in constant danger of being punctured, Mr. John H. Forrest, of Marion, Ind., has devised a wheel in which the tube is located midway between the hub and the tread, thus protecting the tube from rupture and, at the same time, preserving all its cushioning qualities. The tread of the wheel is protected preferably by a hard-rubber tire, although a tire of metal, wood, or composition may be used. The form of the wheel is illustrated herewith. As may best be seen in the cross-sectional view, the wheel comprises a body section *A*, formed of a tread portion with an inwardly-extending annular flange, and a hub section composed of two disk members *B* and *C*, which are firmly fastened together by bolts or rivets *F*. The disks *B* and *C* are so formed as to provide between them an annular chamber, in which the pneumatic tube *D* is placed. From this chamber outwardly the disks are spaced apart to receive the flange of the body section *A*, which bears against the tube *D*. Opposing grooves are formed in the inner faces of the disks *B* and *C* to receive hydraulic or other packing, so as to render the connection between the body and hub sections dust and water proof. A series of openings are formed in the flange of the body section, and passing through these openings, are a set of bolts *E*, which serve to connect the disk members *B* and *C*. The openings are much larger than the bolts, and allow a limited movement between the body and hub sections of the wheel. It will be evident that in practice, the weight supported by the wheel will be carried by the pneumatic tube interposed between the flange section *A* and the hub. The tube *D* may be either a pneumatic tube, a solid rubber ring or a cushion of rubber.



IMPROVED VEHICLE WHEEL.

AN IMPROVISED TANDEM.

The following suggestion culled from a Spanish paper and sent to us by the Rev. R. White, S.J., of Ybor City, Fla., may be found useful for bicyclists who travel in company. In the case of a serious puncture, or other accident to the front wheel of one of the bicycles, if repairs cannot readily be made, a practical remedy is to detach the injured wheel and fasten the front forks of the bicycle to the hind wheel of another machine, as shown in the cut. In this manner the cyclists may complete their journey with the

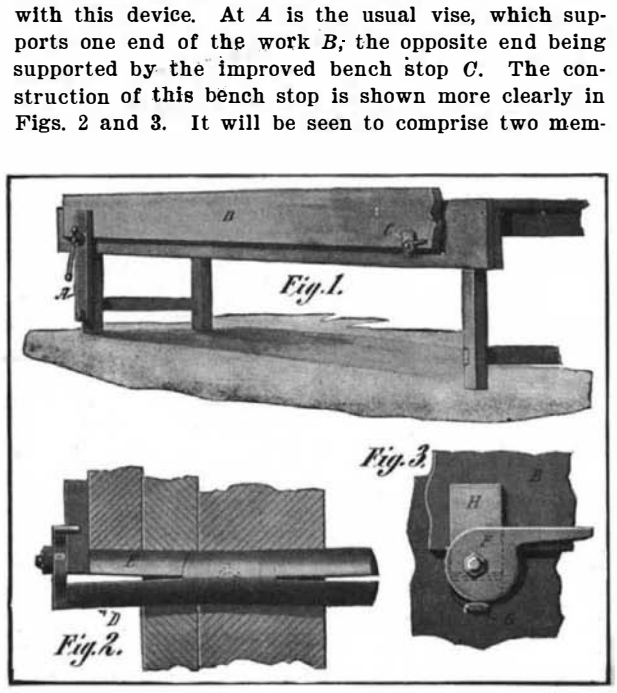


AN IMPROVISED TANDEM.

sole inconvenience of having to carry the crippled wheel, should they think it desirable to do so.

AN IMPROVED BENCH STOP.

Carpenters' benches, as ordinarily constructed, are provided with holes in the apron of the bench, in which pins may be inserted to support one end of the board while the opposite end is clamped in the vise. This method of supporting the work is not without its faults. The pins are apt to work loose and drop out and, furthermore, they do not hold the work firmly against the apron. In the accompanying illustration, we show an improved form of bench stop, which may be locked in the holes in the apron, and which is formed with a jaw adapted to clamp the work tightly against the apron. Fig. 1 shows a bench equipped with this device. At *A* is the usual vise, which supports one end of the work *B*; the opposite end being supported by the improved bench stop *C*. The construction of this bench stop is shown more clearly in Figs. 2 and 3. It will be seen to comprise two members, *D* and *E*, which are hinged together. When in closed position, these members are in the form of a pin. Mounted on the outer end of the member *E* is an eccentric *F*, which is adapted to bear against the lug *G*, formed on the member *D*. The eccentric is provided with a handle, and by depressing this handle, the two sections *D* and *E* are swung open, thereby locking the stop in the apron. The section *E* carries a jaw *H*, which bears against the work *B* and clamps it to the apron. A patent on this improved bench stop has recently been granted to Mr. Merton R. Raynesford, of Ellis, Kansas.



AN IMPROVED BENCH STOP.

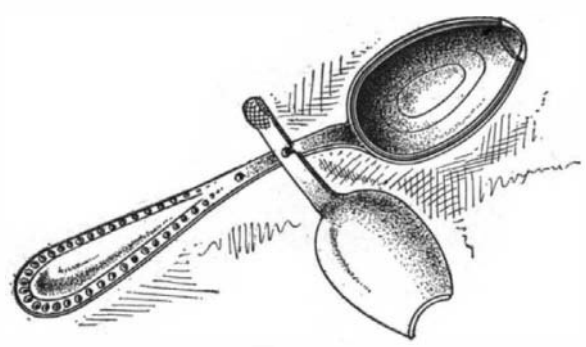
ODDITIES IN INVENTION.

Adjustable Support for Chairs.—A resident of Chicago has devised a support for chairs, whereby the chair seat may be adjusted to any desired height. The accompanying illustration represents this adjustable support as applied to a rocking chair, although it will be evident that it could be used equally as well on any other type of chair. Secured to the under side of the seat, at the rear, is a rack formed of spring metal. The rack is adapted to engage a transverse rod, which is mounted to slide toward the front or the rear of the chair seat. A pair of supports are hinged to this rod

ADJUSTABLE SUPPORT FOR CHAIRS.

at their upper ends, while their lower ends are secured in sliding adjustment with the rockers at the rear. Another pair of supports run diagonally from the forward ends of the rockers to a pair of brackets at the rear of the seat. These supports are journaled on a common pivot where they cross each other. It will be evident from this construction that by lifting the rack out of engagement with the rod, the supports attached thereto may be swung on their pivot to the rear and thus raise the chair seat, or forward to lower the chair seat. The teeth of the rack are preferably inclined rearwardly, so that when it is desired to adjust the seat to a higher level, it will not be necessary to lift the rack.

Medicine Spoon.—The accompanying illustration shows an improved spoon, which will prove of value in the nursery or the sickroom. The bowl of the spoon is provided with a cover, which is cut away at the end to permit pouring out the contents of the spoon without spilling. The cover is formed with a lip which fits into a groove in the edge of the bowl, so that it will be sealed against leakage. When it is desired to fill the spoon the cover may be readily swung to one side, and it may be entirely removed to permit of cleaning the parts. The bowl of the spoon is formed with graduation marks to indicate a teaspoonful, a dessert spoonful, etc., so that the quantity of liquid may be easily measured. The handle is so shaped that when the spoon is laid on any flat surface, the bowl will be held level to prevent spilling of the contents.



MEDICINE SPOON.

Mrs. Chadwick, wife of Admiral Chadwick of the U. S. navy, has invented a carrier for the removal of disabled soldiers from a battlefield.

One of the greatest advantages of the invention lies in the fact that the wounded soldier can be carried in an upright position, so that the loss of blood is diminished in many cases. Another important item is that when the wounded man is being carried between two comrades, the latter would have free use of their arms for handling their muskets. The whole device weighs only six pounds.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT-STUD.—H. W. SPEIGHT, New York, N. Y. The invention has for its object to provide means simple in construction, effective in operation, and comfortable in use, adapted to space the sweat band of a hat from the forehead of the user, and thereby ventilate the interior of the hat. The body of the stud is of a yielding nature and readily conforms to the shape of the forehead.

Electrical Devices.

TELEGRAPH OR ELECTRIC WIRE POLE.—S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. The pole is such as used for supporting electric conductors, and is intended to be especially useful in supporting wires of all kinds, such as electric light, telegraph, or long-distance transmission wires. The object is to produce a durable pole provided with means for attaching the arms or cross trees to the body of the pole.

Of Interest to Farmers.

SUGAR-CANE AND CORN HARVESTER.—E. B. STAFFORD, New Orleans, La. This improved machine is adapted to cut and top sugar cane, corn, or similar crops and to deposit the same in bundles, piles, or stacks, or to deliver it into carts or other receptacles. The cane or corn stalks are severed near the root and also topped practically simultaneously.

EGG-TESTER.—C. M. REED, Mountain View, Oklahoma Ter. This is an apparatus for use in testing eggs and handling them during the testing operation so that the latter may be effected with great rapidity. When all have been inspected, the cover is opened and swung back, and unsound eggs indicated by the marks are removed by a wire forceps, or other means. The sound eggs may be quickly removed from the tester and transferred to an empty filler and the lifter is left free for renewing the operation.

EGG-LIFTER.—C. M. REED, Mountain View, Oklahoma Ter. The device is adapted for use for depositing eggs in, and for lifting and removing them from, some receptacle. Also adapted for use for holding or supporting eggs while their transparency is being tested to determine their soundness. The lifter removes from the case a large number simultaneously, and deposits them in the case again or in any other receptacle.

EGG-CASE.—C. M. REED, Mountain View, Oklahoma Ter. The improvement is in portable cases or boxes for holding and storing eggs and particularly adapted for the use of farmers and storekeepers. The several egg holders are easily accessible so that they may be successively removed in less time than required in a case made in the usual manner.

SELF-DUMPING HAY-RAKE. — A. H. HOGEN, Geddes, S. D. The invention has reference to improvements in self-dumping hay rakes, and is designed to automatically dump the rake as soon as loaded, without interference on the part of the operator; also to automatically dump the hay each time at the same point on the field, thus establishing continuous rows of hay, commonly known as windrows.

Of General Interest.

DEVICE FOR APPLYING MEDICAMENTS.—S. A. WINSOR, Chicago, Ill. The object of the inventor is to provide a device to be used for applying salves or ointments, and with which the medicament may be thoroughly and evenly distributed upon and rubbed into the cuticle, while at the same time the affected surface is beneficially acted upon by the friction of the operation, of advantage, for instance, in the cure of dandruff or kindred diseases.

CANDELABRUM.—O. H. VAN GUELPEN, New York, N. Y. The purpose of the improvement is to provide a construction of candelabra, wherein the arms can be quickly and conveniently placed in position and securely locked in a simple manner, and wherein the arms adapted to the standard of the device can be made to extend therefrom at different angles and yet be rigidly held in position, and wherein the standard may be lengthened or shortened at will.

APPARATUS FOR DISPLAYING ILLUMINATED MULTICOLORED SIGNS OR ADVERTISEMENTS.—H. W. CHINNERY, 118 Millais road, Leytonstone, Essex, England. A stencil in this instance bearing the inscription or design to be exhibited is interposed in the path of a beam of light (natural or artificial) which is transmitted through a multicolored translucent medium and projected by reflection. The word stencil means a screen whereof some portions are translucent, others opaque, the boundaries between being of such configuration as to present an outline or outlines, constituting an inscription or design visible by light projected through translucent portions from the back of the screen.

AQUATIC STAGE.—E. WAKEFIELD, New York, N. Y. The principal object in this invention is to provide a stage that can be quickly erected on the stage of any theater without disfiguring it or making it impossible to use the stage in the ordinary way at a few minutes' notice. It is therefore possible to have an aquatic scene in one act of a play while the remainder of the scenes may be on the permanent stage with the usual scenery, etc.

PROCESS OF TREATMENT OF CLAY CHALK.—J. N. SHYMANSKI, Louisville, Ky. Chalk is usually placed on the market for tailors' use in the form of thin, rectangular pieces tapering in cross section at both sides, providing opposite sharpened edges. This chalk has many weaknesses and the inventor has discovered a treatment of clay chalk which does not impair its marking qualities, removes largely its soft, fragile character, and renders it capable of much longer use than the commercial article.

SPRAY DEVICE.—W. A. SPEAKMAN, Wilmington, Del. The essential objects of the invention are to provide a device which may be accurately regulated as to the amount of water or liquid passing from the same, and so arranged that all parts are subject to ready access to permit inspection, adjustment and repair, without removing it from its permanent setting.

TOE-WEIGHT FOR HORSES.—M. MCNALLEY and E. W. BRETZ, St. Louis, Mo. In the present patent the invention has for its purpose the provision of a toe weight having novel, simple parts that are adapted for quick assemblage into complete form, and that is readily secured in place on the toe in a reliable manner, without injury to the foot of the animal.

CAMERA.—E. L. HALL, New York, N. Y. One purpose of the invention is to provide a construction wherein the focusing mirror is rigidly secured to a tension-controlled shaft, the latter mounted to turn in the frame against which the mirror has bearing when in focusing position, and to provide a second frame loosely mounted upon the shaft, adapted to carry the ground glass and focusing hood, the bearings for the latter or hood frame rendering the frames, mirror and shaft light tight at all points under all positions of hood frame and mirror.

DOUBLE-ENDED OR S-HOOK.—E. J. HILL, 11 Victoria street, Westminster, London, England. This S hook comprises a hook proper and a mousing link which is independent of and wholly separable from the hook and can therefore be disconnected from either or from both ends of the hook at will, yet without being necessarily detached from the hook as a whole, so that both loops (instead of one as usual) may be opened to permit engagement with or disengagement from closed eyes, without the risk of the link being accidentally lost.

HYPODERMIC-NEEDLE CLEANER.—G. T. BARR, San Antonio, Texas. Hypodermic needles are of different sizes and diameters, and to properly clean them a drill should be introduced of a cross section substantially equal to that of the opening of the needle. With this cleaner, the drills suitable to different size needles may be quickly introduced into the handle by pushing them into the recess, and disengaged by lifting upon the thumb-piece to release the catch.

TOE-CLIP.—F. J. MCMONIES and W. H. MCMONIES, Portland, Ore. In this instance the invention has reference to toe-clips of the general type described in the Messrs. McMonies patent formerly granted to them, their present improvement consisting in certain details of construction whereby the means for attaching the toe clip to the pedal are greatly simplified.

BOILER-FLUE FASTENING.—W. H. BOT, JR., Ghent, Minn. In the present patent the invention pertains to improvements in means for securing flues in flue sheets of boilers, the object being the provision of a simple device by means of which a flue may be tightly clamped to the flue sheet, obviating the usual practice of expanding the flue.

FILING-CABINET.—W. A. GIBONEY, Beattie, Kan. The invention pertains to certain improvements in filing cabinets particularly designed for the filing of sheet music, newspapers, pamphlets, books, magazines, documents and the like, and the object is to provide means whereby any desired sheet or folder may be instantly identified and removed from the cabinet.

HOLLOW STONE STRUCTURE.—A. ANGELORO, New York, N. Y. A purpose of the invention is to construct a rustic stone structure in the form of a vase, urn, or other hollow vessel, which vessel will have a facing of what is generally known as natural or cobble stones, and to provide a means whereby the stones will be durably held in place no matter what design or pattern may be employed in the construction of the article.

BATH-CABINET.—C. W. GROOVER, Valdosta, Ga. The invention refers to cabinets for steam or medicated vapor baths and is especially useful as an attachment for and in connection with bath-tubs of the usual kind. The aim is to provide a cabinet or cover by means of which the ordinary bath-tub can be converted into a steam or vapor bath, which is capable of being removed and packed small when not in use, and which the bather can manipulate without assistance.

WALL STRUCTURE.—W. P. FRANCIS, Pensacola, Fla. This invention relates to improvements in wall structure for buildings or the like of a composite character, that is, having inner and outer facing walls of brick, tiling, or other manufactured hard material, and a filling of concrete, the main object being to provide a simple means for clamping the facing or inner and outer walls from bulging out while tamping the concrete fillings, thus providing a perfectly smooth wall.

HIGH EXPLOSIVE.—W. S. WINCHESTER, Chanute, Kan. The invention consists of a new composition of matter in liquid form to be used as a high explosive which shall be stronger than nitro-glycerin, much safer to handle, and practically non-freezing. This new high explosive is to be used as such alone, or as an ingredient in the manufacture of other explosives.

CASEMENT-WINDOW. — I. WRÓBLEWSKI, Warsaw, Russia. The invention relates to improvements in casement windows or windows having swinging connection with the casings, and in which when closed there are practically air and dust proof joints between the sash and casing, the main object of the invention being to provide a means for slightly raising the sash, permitting it to swing.

ORE-CONCENTRATOR. — J. C. TATMAN, Denver, Col. In this patent the invention refers to concentrators using a riffled moving endless apron, and its object is to provide a new and improved concentrator arranged to insure a quick and thorough separation of the valuable metallic particles from the tailings in a very simple and economical manner.

SUPPORTING-PLATE. — S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. The invention pertains to a structural plate or supporting plate to be used in various constructions as an auxiliary support. The object is to provide a plate of this kind having a form especially adapting it to its purposes so that it may be readily secured to the object which it supports and also to the members upon which it rests.

HOLDER.—F. L. LYMAN, St. Louis, Mo. This device is for use in holding a book in an open position, and the inventor's object is to provide a holder, more especially designed for use on the shelf of a piano, organ, or a similar musical instrument, and arranged to hold a music book open at any page and without danger of marring the instrument or tearing or injuring the book cover or the leaves.

INHALER.—J. W. HORNER, Columbus, Ind. This inhaler is for use in the administration of nitrous oxid gas or other gases. The inhaler is provided with valves so arranged that during exhalation the supply of gas is automatically cut off and during inhalation automatically opened or re-established, thus avoiding waste of gas and making a considerable saving to a busy operator.

BILLING DEVICE. — W. R. BOHMERT, Larchmont, N. Y. In this instance the invention refers to certain improvements in billing devices, and more particularly to means for holding a bill and the sales sheet or loose leaf of a sales book while the bill is being made out, and at the same time, copied upon the sales sheet or leaf of the sales book by means of suitable transfer paper.

REINFORCED CONCRETE STRUCTURE.—S. H. LEA, Pierre, S. D. This invention relates to improvements particularly adaptable for use as bridge piers, caissons, or the like, and comprises a strong skeleton frame of steel having its inner and outer faces covered with expanded metal or wire mesh and the annular space filled with concrete. When this structure hardens, it becomes a strong shell of the exact shape required and can be transported and sunk in place without the use of cofferdams or sheet piling.

FIREPROOF CHRISTMAS TREE.—F. L. MCGAHAN, Los Angeles, Cal. While the construction may be employed as a Christmas tree, it may be used as an advertising device or a display rack, and when made upon a small scale may be employed as a toy. The tree may be mounted in various ways, and may be lighted by gas, electricity, or candles.

COUPLING FOR UMBRELLA-HANDLES.—C. MARX, New York, N. Y. The purpose of this inventor is to provide a simple means for coupling the members of umbrella and parasol handles, constructed of more than one piece of material, the coupling being so made that the handle in its entirety will not turn thereon; and a further purpose is to provide a coupling that can be applied directly to the stick or rod and be secured thereto.

Hardware.

HAMMER.—H. C. LYON, Howard Lake, Minn. This tool is adapted to be used for driving nails in shingles and lathing, and especially for overhead work. The hammer is provided with means to contain a quantity of nails, and to deliver them singly at the ball of the tool and hold them in such position in line with the hammer head that they may be partially driven into an object without being handled.

CUTTING-TOOL HOLDER.—F. A. HUMMEL, New York, N. Y. The instrument has been designed to operate upon a rod, shaft, tube, or the like, held by a chuck or a face-plate and dog, or in any desired manner, at the head center of a lathe so as to be rotated, and it is intended to be applied to the work and held by hand or other means in a stationary position centered by the lathe and fed up to the work by the tail center or other means so that upon rotation of the work the operation will be performed upon it by the stationary cutting tool.

WRENCH.—A. L. MOSS, Sandusky, Ohio. As no swinging movement of the handle is required in this improvement it is evident that the wrench can be used to great advantage for turning bolts, nuts, and the like located in places not readily accessible to an ordinary wrench. The tool may, however, be used as an ordinary wrench. Mr. Moss has invented another wrench such as shown and described in his application for former Letters Patent of the U. S. Its object is to provide a new and improved tool, more especially designed for turning nuts, screws, and other articles in places not easily accessible by ordinary wrenches.

WRENCH.—R. A. SMITH, Laurelville, Pa. The wrench comprises the combination of a toothed shank with a fixed and sliding jaw, and a frame constituting an attachment of the jaw comprising an interrupted screw journaled concentrically at its ends in the frame of the jaw, the lever secured to one of the screw journals and adapted to fit around the wrench shank, and a spring adapted to engage at its free end with the shoulder of the lever for locking it in closed position, both lever and spring lying flush with the slotted head.

Heating and Lighting.

STOVE.—W. B. KIMMEL, Boise, Idaho. The stove is especially designed for military or camping uses. The object of the invention is to provide a stove strong, light, and durable, and which can be packed into a small compass by placing certain parts within other parts. The oven is adapted for cooking of food through chambers for the circulation of hot gases from the fire.

STOVE, FURNACE, OR DRUM.—J. H. HANSON, Aitkin, Minn. The hot gases are brought into close contact with the outer wall of the stove so as to give opportunity for the wall to absorb the heat from them. An arrangement of disks tends to choke the flow so as to give time for this heat absorption. There is no danger of an actual choking of the draft, as the area of annular spaces surrounding the disks through which the gases pass, is always equal to or more than equal to the area of the stove pipe.

Household Utilities.

PNEUMATIC MIRROR-BRACKET.—G. W. DAYTON and S. P. HOTALING, King City, Cal. The invention refers to brackets for supporting mirrors, and has for its purpose peculiar and novel means specially intended for holding a mirror but adapted for other uses. It resides in a bracket employing pneumatic, or suction, devices, providing ready means for attachment of the bracket to any suitable perpendicular plane.

IRONING-TABLE.—A. E. FRENCH, Indianapolis, Ind. In the present patent the vertical frame is telescopic, and the prop which supports the ironing-board proper in horizontal and working position is also telescopic, so that the board may be adjusted vertically at different heights to accommodate ironers of different stature.

FRUIT-JAR HOLDER.—ANNIE F. HORNER, Enid, Oklahoma Ter. Of the several features of this invention the most important is the connection between the funnel and standard, which permits the former to be raised or lowered or swung laterally, and which causes the weight of the funnel to automatically lock the same in any position, adjusted. Extending outwardly from the funnel adjacent to its upper edge, is an eye embracing a standard but of sufficient size to move freely upon it when the axis of the ring is alined with the axis of the standard.

PNEUMATIC CLEANER.—A. RICHTER, 76 Boulevard Michel Brézin, Garches, Seine et Oise, France. This apparatus allows of acting inside the carpets and the like, so that the cleaning will be very efficient. The pipes are inserted in clothes, pillows, eider-downs, or carpets by suitable rotation of a screw. Air escaping from the pipes spreads through and removes the dust, which latter is sucked in a chamber and carried off by a pipe.

WINDOW-SCREEN.—S. E. SNEDEKER, White Plains, N. Y. There is provision in this invention for a screen in which the screen is supported upon a roll and in which the screen may be adjusted and secured in position as desired. The invention is particularly useful in connection with devices in which the screen, intended to prevent the entry of insects, dust, etc., through the window, is adjustable.

CLOTHES-PIN.—C. W. OTT, Pittsburg, Kan. The object of the inventor is the production of a clothes-pin which may be readily applied and disconnected, and which will operate to hold the clothes securely. A further intention is to give the pin a form which will enable the same to be readily gathered upon a holder.

COOKING-STOVE.—F. OBERBECK, New Athens, and C. T. TAYLOR, Mount Sterling, Ill. In this cooking stove, fresh heated air is admitted to the oven, causing the evaporation to take place faster and thereby removing the moisture from the material being cooked and causing such material, particularly bread, to bake much quicker. The number of flues and dampers existing in the common form of cooking stoves is reduced, and the means for providing air circulation through the oven results in thorough, even and healthful cooking of food.

SHELF-SUPPORT.—J. McDOWELL, SR., New York, N. Y. In this patent the invention pertains to improvements in shelf supports, and more particularly to means adapted to be readily secured to any bookcase or cabinet and provide a firm support for the shelf, the support being capable of adjustment to hold the shelf at any suitable elevation.

THIMBLE.—GRACE F. HOLDEN, New York, N. Y. The object of the improvement is to produce a thimble which is adapted to fold into a compact form so that it may be readily carried in a lady's purse or card-case. Further, to produce a construction which will enable the thimble to be readily opened out for use, by a simple movement of its parts.

Machines and Mechanical Devices.

COIN-CONTROLLED VENDING-MACHINE.—A. C. WAY, Perry Center, N. Y. The machine delivers towels, and is so constructed that while those delivered can be conveniently used for all legitimate purposes they can not be disconnected from the guide element forming a portion of the machine after leaving the body of the latter, but the towels after having served their purpose are automatically conducted to a locked receptacle to be removed therefrom for washing by authorized persons.

BORING-MACHINE.—E. J. WHEELER, Bryson City, N. C. This machine accurately centers both square and round timbers at each end and holds them against rotary movement while the boring is accomplished. It provides for boring both ends of a timber without the necessity of changing or shifting its ends in the machine, and permits centering and clamping means to move independently and transversely of the machine in order that the timber may be bored out of center when desired.

SHIFTING MECHANISM FOR TYPE-WRITERS.—J. B. VIDAL, Habana, Cuba. More particularly the invention relates to means for shifting the roller to bring different letters on the type levers into operative relation therewith. The object is to provide means whereby the shift key may be operated by the ball or palm of the hand, thus leaving all the fingers available for operating the type keys.

CARRIAGE-ACTUATING MECHANISM FOR TYPE-WRITERS.—J. B. VIDAL, Habana, Cuba. The improvement is more particularly in means employed for returning the carriage to its original position at the right-hand side of the machine after each line is written, and for rotating the roller to bring a fresh portion of the paper into operative engagement with the type. The carriage may be moved longitudinally and the roller simultaneously rotated without removing either hand from the keyboard.

TYPE-WRITER CASE.—J. B. VIDAL, Habana, Cuba. This improvement more particularly comprises a case designed to inclose all parts except the key board, and is so designed that the machine may be operated while inclosed within the case. It is so constructed as to deaden sound when the machine is operated, and to permit the operator to see the work as it is being done. It excludes all dust, thus it is unnecessary to inclose the machine when the latter is not in operation.

MECHANICAL MOVEMENT.—W. B. KIRBY, Wellington, Texas. The invention has reference to mechanical movements, the more particular object being to provide a movement for use upon mechanical motors to be employed, for instance, upon well pumps. The movement increases the power of the motor so that less energy than usual is required in operating the motor.

WASHING-MACHINE.—J. W. BEDINGFIELD, Florence, Ala. Steam is utilized to cleanse the clothes in this machine. The clothes are held within foraminous or woven wire receptacles within a boiler in which the water is contained, so that a circulation of steam is provided through the articles being washed. A pounder or agitator agitates or presses the clothes during the operation.

COMPUTING DEVICE.—F. P. GLASNER and J. J. GLASIER, Springfield, S. D. The invention relates to improvements in computing or adding and subtracting devices combined with a measuring ruler, the object being to provide a device that may be produced at a small price because of its simple construction, and that will be found very useful as an article of desk furniture.

TREADLE ATTACHMENT FOR TOY SEWING-MACHINES.—C. B. REPP, New York, N. Y. A purpose of this inventor is to provide an attachment for hand sewing machines, particularly adapted for use in connection with miniature or toy machines, whereby to obtain greater rapidity and steadiness of action than when such a machine is run by hand, and to render the labor of running very slight.

CLOCK.—A. S. PEREDO, Coatepec, Vera Cruz, Mexico. The striking attachment provided is particularly for alarm or striking clocks, and is independent of the customary alarm or striking mechanism. It provides a single stroke of a bell, gong or its equivalent at any desired interval, as for instance every five, ten, fifteen, twenty, thirty or sixty minutes, which auxiliary attachment may be silenced when desired and may be operated in conjunction with the ordinary alarm and striking mechanism of the clock without in any way interfering therewith.

PACKING-MACHINE.—R. HOYT, New York, N. Y. The invention refers to machines for arranging packages in cases, its principal object being to provide an effective apparatus to automatically accomplish this end. When case after case is filled, it is only necessary to supply packages through a chute and place the cases with their guide-frames upon the support. When each has received its contents, the frame is withdrawn and the case is ready for closure.

AIR-SHIP.—L. HAINES, Colchester, Ill. This ship is intended to be of strong and light construction embodying a novel form of propelling means which when driven, act to overcome the force of gravity and simultaneously drive the ship forward. In one form the direction of travel is controlled by a rudder at the extreme rear end, and the relative vertical position of the stern is controlled by rudders arranged at each side thereof, means being provided for readily controlling the position of the rudders at a convenient part of the ship.

FIBER-CLEANING MACHINE.—J. F. FARIAS, Monterey, Mexico. This invention relates to improvements in machines for removing the outer covering and pulp of fibrous material such as sisal, palma, lechuguilla and analogous plants, the object being to provide a machine for this purpose, simple in construction and by means of which the work may be rapidly carried on.

COIN-CONTROL FOR VENDING-MACHINES.—S. C. GILBERT, Jackson, Ohio. The invention refers particularly to automatic machines of the vending class which are operated by the insertion of a coin of a certain denomination. The object is to produce a machine having means for controlling the coin, which will prevent the fraudulent operation of the machine by a spurious or counterfeit coin.

SHOE-POLISHING MACHINE.—P. CUMMING, Key West, Fla. The object among others of this invention is the production of a machine embodying a novelly-constructed brush holder in which the brushes may be readily and quickly changed to suit the different stages and kinds of shoe-shining required, also to provide a seat for the operator having suitable foot power means for driving the polishers.

FLY-TRAP.—W. J. D. BRANSCOM, Mobile, Ala. Devices are provided upon which flies alight, and such devices which thus constitute perches or roosts, are connected with spring actuated frames of box-like form, which are hinged together and adapted to inclose the roosts, and when released by manual operation of trip mechanism, the parts assume normal working relation. Outer sides of the frames are formed of woven wire which enables flies to be destroyed by flame or water when entrapped by closure of the frames.

BINDING-MACHINE.—C. F. MCBEE, Athens, Ohio. In the present patent the invention is an improvement in machines for use in binding paper or other sheets, such, for instance, as way-bills, checks, and the like. It relates to that class of machines illustrated in a former patent granted to Mr. McBee. Movable side plates may be readily adjusted to any desired width of book and secured in such adjustment by tightening devices.

GUN.—I. A. TOMASINI, Guadalupe, Cal. The locking bolt may be released by either the rear trigger, or by a swinging lever upon the upper face of the lock frame, each acting independently of the other. When the bolt is drawn to the rear by the trigger, the slot in the upper face of the bolt permits passage of a crank arm, and when the lever is turned to rotate the pin, a curved depending arm turns upon its pivotal connection with the bolt without affecting the trigger. Manipulating the swinging plate upon the upper face of the lock frame causes the trigger to release the sears in sequence beginning with either barrel.

FEEDING DEVICE.—G. HALLIDAY, Superior, Wis. The invention relates to devices for feeding flour stock and other materials in a thin stream to a machine for further treatment of the material. The device is arranged to insure the formation of a thin and uniform stream of material throughout the width of the feed-box and without danger of blocking or choking up by the stock or foreign materials that may be in the stock.

FLYING-MACHINE.—W. H. COOK, Edmonds, Wash. In the present patent the invention has reference to flying machines, the object being to construct a flying machine having an aeroplane capable of raising and supporting a car or basket, without the agency of a gas bag or balloon. The means provided direct the course of the aeroplane so that it can make progress across the sky in a substantially horizontal direction.

Prime Movers and Their Accessories.

INTERNAL-COMBUSTION ENGINE.—E. CROWE, 25 Teresa terrace, Coatham, Redcar, Yorkshire, England. Mr. Crowe's invention has for its object the provision of an internal combustion engine wherein premature explosion is rendered impossible and wherein the maximum temperature and pressure being developed at the commencement of the working stroke, the highest possible average pressure and the maximum power are obtainable with a given capacity of cylinder.

VACUUM-CONTROL VALVE.—E. L. CRIDGE, Passaic, N. J. The improved apparatus is intended to operate to quickly break or destroy the vacuum, by the admission of atmospheric air, so that the motor which extracts air from the condenser will be stopped more quickly than would be otherwise practicable, and also the danger of water being drawn into the cylinder of the engine will be avoided.

ROTARY ENGINE.—A. W. COTTRELL, Arizona Territory. The cylinder rotates around a stationary shaft, and may be utilized as a pulley for transmitting power, the steam or other driving fluid being introduced through one end of the shaft and exhausted through the other. The cylinder or rotary casing carries pistons which pass swinging abutments set in a hub which also contains the inlet and exhaust ports controlled by the abutments. Automatic cut-off valves in the inlet ports are controlled by centrifugal governors. The cut-off valves are rotary valves, and give quick and effective action with small movement.

MUFFLER.—W. H. SMITH, Wichita, Kan. The object of the invention is to provide a new and improved muffler, more especially designed for use on gasoline and like explosive engines, and arranged to deaden the exhaust at the same time allowing comparatively free escape of the exhaust gases without producing undue back pressure.

Railways and Their Accessories.

AUTOMATIC SAFETY-SWITCH.—G. E. RYAN, New York, N. Y. The object in this case is to provide an arrangement which will prevent accidents from trains running into open switches. The invention contemplates the use of a track device which is disposed in the track near the switch and which is controlled by the position of the switch. The locomotive or some part of the train is provided with a trip device adapted to be struck by the train device so as to cut off the power.

END-DUMP CAR.—H. S. POTTER, Jersey City, N. J. The purpose of the inventor is to provide a railroad car adapted for construction usages, of large capacity, and which dispenses with trestle work, and wherein the body of the car will dump at the end of the bed or platform instead of at the sides, enabling the material carried by the body to be readily shoveled to either side of the track or deposited directly upon the road-bed, thus greatly facilitating the building up of the latter.

LOG-UNLOADER.—A. G. HARBAUGH and C. W. DETERING, Seattle, Wash. The intention of the inventor is to provide a new and improved log unloader, which is simple and durable in construction and arranged to form a permanent fixture of the log-carrying car, and to allow convenient and quick rolling or pushing of the log from the car without danger to the operator.

STATION-INDICATOR.—H. A. HILL, Delafield, Wis. The invention refers to improvements in station indicators for railway cars and street indicators for street railway cars, the object being to provide an indicator with the parts so arranged as to automatically and positively indicate the various places, thus not only adding to the general comfort of the traveling public but to relieve the attendants from calling out the stations.

ROLLER-BEARING.—E. J. EDWARDS, Los Angeles, Cal. The invention relates to improvements in roller bearings, and more particularly to means for spacing and guiding the rollers and carrying the end thrust. By supporting the rollers at both ends, they are always kept in alinement and in their proper place, and it is impossible for one end of any roller to get ahead of the other.

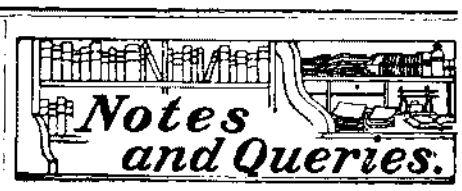
AUTOMATIC LUBRICATING APPARATUS.—T. YAHIRO, 80 Shiba-Kurumacho, Shiba-Ku, Tokyo, Japan. This invention is an improvement in automatic lubricating apparatus. In assembling the device, the oil leading means is first placed in position, after which the front and rear walls of the reservoir are riveted together, and the reservoir is placed in proper position on the wheel and secured thereto. A ring which also acts as dust protector is then placed in position, after which the journal of the axle is inserted in the journal box and the parts secured together.

Pertaining to Vehicles.

SPEED-RECORDER.—G. LENNOX, Hasbrouck Heights, N. J., and R. S. STOTT, New York, N. Y. The invention relates to speed recorders and counters, such as carried by vehicles for recording the speed thereof or the distance traveled. While the invention may be used as an attachment for any moving vehicle, it is especially useful to the users of automobiles.

TRACE-HOLDER.—T. THOMPSON, New London, Wis. This device is applied to the end of the swingletree for securing the trace and for clamping the free end of the trace, so that said end will not hang over the thill in contact with the wheel of the vehicle. The holder is bent out of a single piece of wire and pivoted on one side of the swingletree so as to swing into and out of operative position. The outer end passes through a hole in the tree outside of the trace and at the inner end a loop is formed on the holder for retaining the extreme end of the trace.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(10596) C. H. C. says: I am desirous of constructing a large spark coil. Will you please inform me as to where I could secure the most reliable authority on the building of induction coils, such as relates to the proper dimension of core and size of wire to obtain the best results? A. SCIENTIFIC AMERICAN SUPPLEMENT 1402, price 10 cents, gives full information for coils up to 12-inch spark. For an excellent work on induction coils we recommend and can supply "Induction Coils. How to Make, Use, and Repair Them," by Norrie, price $1 by mail.

(10597) V. L. B. says: Please answer the following questions in your columns of Notes and Queries: Has charcoal been reduced to the liquid state, and if so, is it of any scientific use in that form? A. We have no knowledge of charcoal being liquefied. The utility of such a process would depend on the chemical and physical properties of the product. We are inclined to think that use could be found for it. 2. Will ice melt in a vacuum, or simply vaporize? A. A substance cannot be melted if the pressure upon it is less than its vapor pressure at its melting point. The pressure of aqueous vapor at the freezing point of water is 4.6 mm. Hence in a vacuum of less than 4.6 mm. of mercury ice cannot be melted.

(10598) C. N. M. says: I wish to learn how much horse power a wheel will produce in a stream running 4 miles per hour, 4 feet deep, 24 feet wide. What is the best system for a wheel, etc.? A. A stream running 4 miles per hour, 4 feet deep, and 24 feet wide, would develop, if it were possible to utilize all of the energy in the water, 0.6 horse power. With a paddle-wheel covering the full cross-section of the stream, it would be impossible to utilize more than one-third of the above amount, or 0.2 horse power. The scheme, therefore, as you suggest it, seems hardly feasible. If, however, it were possible to obtain a fall of even a few feet, there is sufficient water here to give a valuable water power. With a fall of 10 feet, very nearly 10 horse power could be developed.

(10599) G. R. B. says: Will you kindly oblige me by answering the following question in your Notes and Queries of the SCIENTIFIC AMERICAN? What is the specific heat at about 250 deg. F. of syrup of such a consistency, that is, containing such an amount of water that when cooled to about 100 deg. F. it will become a thick pasty mass which will just be able to flow? I have consulted various works as have been at my disposal, and am unable to find any reference to the specific heat of sugar or syrup at any stage of its manufacture. A. We would say that we do not know of any exact data giving the specific heat of sugar syrup at different temperatures and different densities. We doubt if such data exist. This specific heat probably does not differ very greatly from that of water. It is a simple matter, however, for you to determine this for yourself by mixing a known weight of syrup at a known temperature with a known weight of water at a lower temperature, stirring the mixture and carefully noting the temperature of the same. It will be necessary for you to allow for the heat given to the vessel containing the water. It would be well for you to use a thin copper vessel for this purpose, because then the heat which it would absorb could be accurately calculated. The formula to use is as follows: (Weight of cool water × weight of copper vessel × .0933) × increase in temperature = specific heat of syrup × weight of syrup × decrease in temperature in syrup. This is a very simple experiment, and if carefully performed, with an accurate thermometer, will give you just what you want.

(10600) W. M. R. says: Can you give me the name of a substance, not a metal, that is cool, elastic, and tough? Something better than rubber or cork, if you know of such a substance. Will you kindly give me the pull in pounds necessary to straighten a hook made of steel ½ inch broad, 1-16 inch thick and bent to form a loop 5-16 inch in diameter, pull to be exerted by a ring working in the loop? A. It is difficult to answer your question in regard to a substance not a metal, which is

cool, elastic, and tough, without knowing the purpose for which you wish to use it. Porcelain is such a substance. Celluloid is another. But possibly neither of these will meet your requirements. The force necessary to straighten out a hook ½ inch wide, 1-16 of an inch thick, bent in the form of a loop 5-16 of an inch in diameter, will be about 180 pounds. This will vary somewhat with the character of the steel. We have figured on an open-hearth steel, with a tensile strength of about 70,000 pounds per square inch. If tool steel were used, the force required would be about twice as great. A factor of safety should be allowed if this is to be used in construction, which would reduce this figure to about ¼ or 1-6 of the amount given above.

NEW BOOKS, ETC.

LE COÛT DE LA FORCE MOTRICE, LE LABOURAGE ELECTRIQUE. Par Emile Guarini, Professeur à l'Ecole d'Arts et Métiers de Lima. Paris: H. Dunod et E. Pinat. 8vo., 28 pages, 22 illustrations. Price, 50 cents.

The author, after comparing the cost of the motive power produced by man, the horse, the ox, and the electric motor, discusses at length the use of the latter in undeveloped countries, such as Peru. Plowing is next studied, the conclusions drawn being in favor of electricity as a tractive agent. Details of electric plows, motor vehicles, etc., with explanatory drawings, complete this unique monograph in a most practical manner.

A PRACTICAL GUIDE FOR AUTHORS. By William Stone Booth. Published by Houghton, Mifflin & Co. 180 pages. Price, 50 cents.

The author of this little book has some excellent advice to young authors and much of it could be well utilized by authors of experience. While the rules forming the text seems obvious yet the patience of editors is constantly being tried by manuscripts that are not properly prepared and which had the author known, or knowing had heeded, the labors of the book-makers from editors to proofreaders would be very considerably lightened. About a third of the book is devoted to the preparation of manuscripts; offering a MS. to publishers; royalties; dealing through literary agents; copyrights; serial rights, and agreements. The necessary amount of space is given to proofreading and the signs used in proofreading, while the rest of the book contains American and English rules for spelling and pronunciation; rules for French and German spelling and the division of Latin and Greek words. Thus it will be seen that the book covers those points that many aspiring authors are in the dark about and a perusal of this volume will quickly enlighten them.

SUR UN ORGANE NON DECRIT DU THORAX DES FOURMIS AILÉES. Par Charles Janet. Extrait des Comptes Rendus Hebdomadaires des Seances de l'Académie des Sciences, Paris.

A description of two diaphragms in the thorax of ants, which have never before been noted. These organs, found alike in the male and female, no doubt serve to produce a displacement of the blood during the periods of repose of the vibratory wing muscles, or after the disappearance of these muscles.

CLOVERS AND HOW TO GROW THEM. By Thomas Shaw. New York: Orange Judd Company. 12mo.; cloth; 349 pages. Price, $1.

Clovers play a very important part in American agriculture in a number of ways. As a fodder, for pasturage, as a honey-producer for bees, and as a soil-enricher, clover, in some one of its varieties, can be called into service. Chapter I of this work is an outline of its nature, scope, and plan. Chapter II deals with the facts and principles that relate to the growing of clovers in general. Chapters III to XI inclusive treat of individual varieties, a chapter being devoted to each variety. Chapter XII is devoted to a brief discussion of miscellaneous clovers, which have been but little grown in this country or are of but local interest. The author has devoted space to each kind in relation to its importance.

COLORING MATTERS FOR DYEING TEXTILES. With numerous engravings and diagrams. By Prof. J. J. Hummel. New and revised edition. Edited by Paul N. Hasluck. Philadelphia: David McKay. 16mo.; cloth; 160 pages. Price, $1.

The field of aniline colors is so great, that a work embodying all the knowledge possessed on the subject would be prohibitive in its size. This little handbook contains a selection of the more important colors in technical use, and a sufficient amount of the theoretical principles covering their action.

LOCOMOTIVES: SIMPLE, COMPOUND, AND ELECTRIC. By H. C. Reagan. Fifth edition, revised and enlarged. New York: John Wiley & Sons. 8vo.; cloth; 932 pages; 494 illustrations. Price, $3.50.

This edition has been revised by the author to include the latest developments of steam and electric locomotives. The development of the steam locomotive includes the balanced four-cylinder compound and the steam superheater. The principle of compounding has been described in full as applied to locomotives both in the United States and foreign countries, involving the use of two-, three-, and four-cylinder engines. A chapter has been devoted to foreign-built compound engines, some types being described which are not modern, because they show the efforts put forth at their respective periods to improve the compound locomotive, and they form part of the evolution of the compound engine. The rapid development of the electric locomotive, and its use on trunk-line operations, require the treatment of the construction and operation of the electric locomotive in great detail, together with the apparatus essential to the generating and transmitting of the current which operates the locomotive. The principles of the generating and translating apparatus and the method of application are explained. The systems of construction and operation of the electric locomotive are described, to wit: The single-phase system, using single-phase motors; the polyphase system, using induction motors; the three-phase system of generation and transmission, using rotary converters, with direct-current motors on the locomotive; the three-wire, direct-current system and the simple direct-current system, using a trolley and ground return. The methods of control and the electric brake-apparatus are described.

PUMPS AND HYDRAULIC RAMS. Edited by Paul N. Hasluck. With numerous engravings and diagrams. Philadelphia: David McKay. 16mo.; cloth; 160 pages. Price, 50 cents.

Pumps are so much a necessity, and hydraulic rams furnish such easy means for supplying water to country houses, that a popular treatise on the subject is not without use. Although this work deals with all forms of pumps and of rams, from the simplest to the most complicated, the illustrations are so clear and the descriptions so well written that they can be understood without any difficulty.

INSTRUCTIONS FOR THE INFANTRY PRIVATE OF THE NATIONAL GUARD. By Capt. John W. Norwood, late First Lieutenant 23d United States Infantry. New York: Arms and the Man Publishing Company. 80 pages. Price, 25 cents.

The National Guard to-day is composed of men willing and anxious to become proficient in their duties, but opportunities for drill and instruction under the supervision of company officers are necessarily limited. The various textbooks and regulations require a certain amount of technical knowledge and experience for the proper understanding of them. "Instructions for the Infantry Private of the National Guard" enters into an elementary discussion of the subjects which are most important to the private. It treats of military courtesy, discipline, customs of the service, camp duty, and guard duty in an interesting and entertaining way. To the important subject of rifle practice much space is given. The appearance of the book at the present season makes it of special value for those about to go into camp. It is made up in handy book form, completely indexed for ready reference.

AMERICAN MAGAZINE OF AERONAUTICS. Published monthly at 142 West 65th Street, New York. Ernest La Rue Jones, Editor. Price, $3 per annum.

We welcome this addition to the literature of aeronautics. The necessity of such a journal is apparent when the importance of this field is considered. Aeronautical journals are few in number the world over, and every creditable addition will be eagerly sought after. Among the articles in this initial number are: "Aeronautics at the Jamestown Exposition," by Israel Ludlow; "Conditions of Success with Flying Machines," by O. Chanute; "Theory of Balloon Leakage," by A. F. Zahm, Ph.D.; "English Aero Club Exhibition," by Wilbur R. Kimball. Among the other articles are: "First Private Aerodrome in America"; "The Aero Club of Philadelphia"; "Gordon Bennett International Aeronautic Cup Race;" "Progress in Aeronautics"; "Aero Club of America"; "Aeronautics in England," etc. Twenty-five cents will bring a sample copy, and its perusal will prove profitable.

SELF-PROPELLED VEHICLES. A Practical Treatise on the Theory, Construction, Operation, Care, and Management of all Forms of Automobiles. By James E. Homans. Sixth Edition, revised and enlarged. New York: Theodore Audel & Co. 8vo.; cloth; 598 pages; 500 illustrations. Price, $2.

Although the automobile is an element of modern life that has too firm a hold to be easily shaken off; and although its design and construction have been brought to a very dependable degree of efficiency and simplicity, the driver of motor cars has many problems to face. To answer every question that might arise would be too vast a task; but to anticipate each question by explaining the underlying principle, though difficult, is a task that can be accomplished. The course followed is to take each part of the mechanism, to describe principles governing its operation, and then to take up in detail the leading types in use. In this manner, every phase of automobiling is dealt with, from the putting on of tires to steam gages.

CASEIN. Its Preparation and Technical Utilization. By Robert Scherer. Translated from the German by Charles Salter. London: Scott, Greenwood & Son. New York: D. Van Nostrand Company. 8vo.; cloth; 163 pages. Price, $3.

The casein industry, though limited at present, offers dairymen a growing market for their skimmed milk, a purely waste product of the cream-separator. The uses to which casein can be put are so numerous that it must, in time, become a product of the greatest importance, replacing, perhaps, celluloid and similar compounds in their universal usefulness. Mr. Scherer, in his translation from the German of Charles Salter, takes up the subject from the beginning. He first tells of the preparation of the compound, of its origin, and of its properties, and then how it can be used. The description of its uses is a practical handbook, containing in nearly every case the full recipe and directions.

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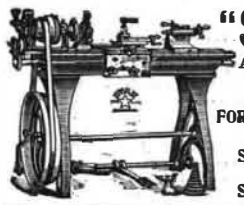

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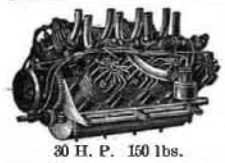

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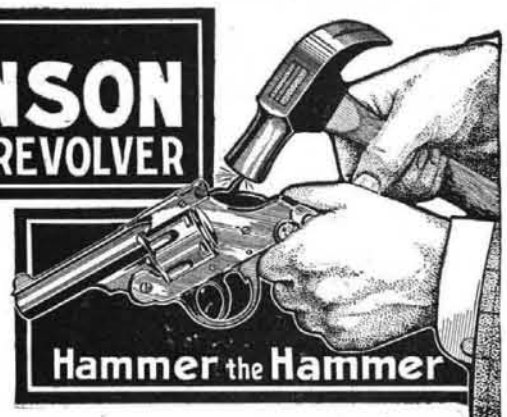

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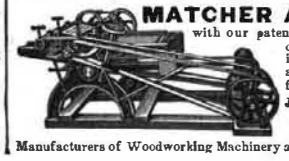

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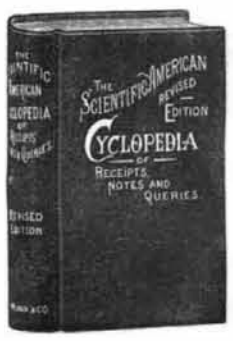

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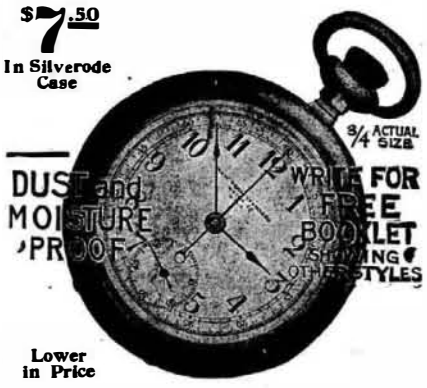

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Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

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Illustration shows furnace, without casing, cut out, to show how coal is forced up under fire, which burns on top

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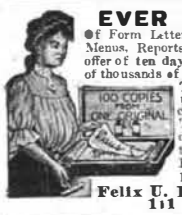

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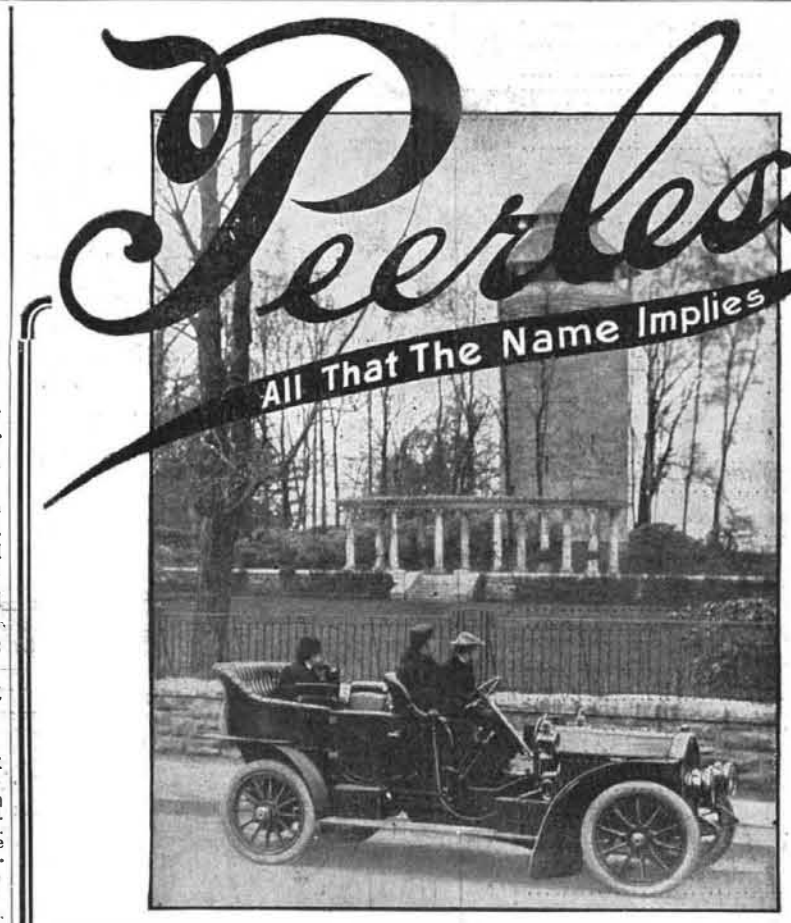

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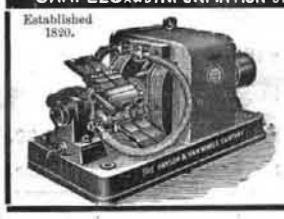

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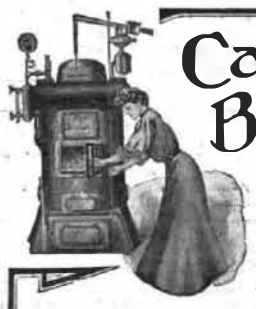

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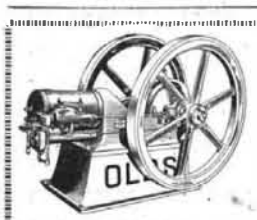

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